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TRENDS AND PATTERNS OF CANCER MORTALITY IN KAZAKHSTAN IN COMPARISON WITH SOME SELECTED EUROPEAN COUNTRIES FROM 1986 TO 2008

Master Thesis

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I declare that this thesis is my own work under the supervision of RNDr. Boris Burcin, PhD. and RNDr. Olga Sivkova, PhD. Where other sources of information have been used, they have been acknowledged.

I agree that if any results gained while working on this thesis will be used outside the Charles University in Prague, written permission of the University will be necessary.

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In Prague Askat Ashimov

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Trends and patterns of cancer mortality in Kazakhstan in comparison with some selected European countries from 1986 to 2008

Abstract

This thesis primarily addresses mortality patterns and trends by main causes of death and by major neoplasms in Kazakhstan in comparison with the selected European countries: the Czech Republic, France and Sweden during 1986-2008. Within the whole group of main causes of death, the changes of mortality levels in different groups of neoplasms are analyzed. The analysis is accompanied with the comparison of mortality levels from major neoplasms within the selected countries. Afterwards the thesis focuses on cancer causes and risk factors in the countries under observation. The analysis concludes that the current mortality situation in Kazakhstan follows up long term adverse mortality trends of the past two decades and neoplasms remain an important public health problem in Kazakhstan.

Key Words: mortality, cancer, malignant neoplasms, cause of death, standardized mortality rates, comparison, Kazakhstan, Czech Republic, France, Sweden

CONTENTS

LIST OF ABBREVIATIONS

AIDS	Acquired immune deficiency syndrome
ASDR	Age-specific death rate
ASMR	Age-standardized mortality rate
CDR	Crude death rate
CVD	Cardiovascular diseases
EU	European Union
HFA-DB	Health for All Database
ICD	International Classification of Diseases
IMR	Infant mortality rate
MN	Malignant neoplasm
NIS	Newly Independent States
UN	United Nations
USSR	Union of Soviet Socialist Republics
WHO	World Health Organization
WHO MDB	World Health Organization Mortality Database
YPLL	Years of potential life lost

LIST OF TABLES

LIST OF FIGURES

Chapter 1

Introduction

1.1 Problem definition

In contemporary demography the analysis of mortality from neoplasms is a matter of a growing interest of researchers due to increasing importance of this group of causes of death in the total intensity of mortality. The term “cancer” is commonly used to cover a wide range of diseases, which all share a common feature, namely that cells in affected organs or tissues of the body (e.g. breast, lung, colorectal or prostate) continue to grow indefinitely, without reference to the needs of the body. Many cancers have the capacity to spread to other parts of the body and to kill the patient. With more than 3 million new cases and 1.7 million deaths each year, cancer currently represents the second most important cause of death and morbidity in Europe and cancer control is clearly one of the biggest challenges of the 21st century. The most common sites at which cancer appear are breast in women, prostate and lung in men and colon and rectum in both sexes (Ferlay 2007).

Cancer is also becoming a main health problem for most post-communist and European countries, driven principally by world population growth and aging. According to the estimation from the International Agency for Research on Cancer, the estimated global numbers were 12.4 million new cancer cases and 7.6 million deaths in 2005. Cancer deaths will continue to rise. By the year 2030 the burden is set to more than double: there will be 26.4 million cancer cases, 17 million deaths and 75 million people living with the disease (IARC 2005). Globally, cancer is a major public health burden, accounting for one in eight deaths overall more than AIDS, tuberculosis and malaria combined.

Kazakhstan has been occupied over the last decade with the enormous challenges of establishing and stabilizing its state and society and with claiming its place in the international community. Since gaining independence in 1991, Kazakhstan has received more attention from international community, especially given the political and economic significance of the region. Because morbidity factors concerning cancer are not well known outside Kazakhstan, this Master thesis aims to describe and analyse them for a wider audience.

Non-comunicable diseases, especially cancer, cardiovascular diseases and diabetes are major public health issues in almost all countries in the Asian region (WHO 2005). One of the major current problems in Kazakhstan public health system relates to the increasing age standardized incidence rates from cancer, because treatment of cancer diseases is more expensive than other diseases, and affects state budget. Cancer is the second after CVD as the leading cause of death in Kazakhstan. Nowadays, we have an opportunity to analyse the changes in mortality over time based on the datasets from the international data source, from the World Health Organization Mortality Database. We are going to give an image of Kazakhstan in the context of selected European countries: (the Czech Republic, France and Sweden) in respect to life expectancy at birth, cause-specific mortality and major neoplasms in the period of 1986-2008, because little research has been devoted to this topic recently, this study aims to fill this gap. The analysis of the age-standardized mortality rates among the selected countries: Kazakhstan, the Czech Republic, France and Sweden started from the period of the restructuring of the Soviet political and economic system and pre-dissolution time in Kazakhstan (1986). The end of the study period is time of relative economic stabilization in Kazakhstan (2008).

1.2 Research goal and objectives

The goal of this thesis is to study trends in mortality intensity from neoplasms in Kazakhstan, through detailed descriptive analysis of cancer mortality changes observed in comparison with the selected European countries, during the period 1986-2008. In accordance with the purpose of the study, we defined the following objectives:

- to analyze differences in total mortality measured by life expectancy by age;
- to focus on differences in cause-specific mortality levels by main groups of causes of death;
- to identify differences in cancer mortality time trends among the selected countries, including differences in trends by sex, age group, and major neoplasms;
- to describe the factors leading to the growth and spread of cancer sites.

1.3 Cognitive and practical relevance of the theme

The analysis of mortality development in the countries under observation has been an inseparable part of demographic research, because without detailed knowledge of the process, we can not understand the population development as a whole. Analysis of cancer mortality in Kazakhstan is of specific scientific interest. First of all, since taking independence in 1991 Kazakhstan has undergone an enormous socio-economic transition and has also experienced an important change in mortality. In general, the mortality gap between Kazakhstan and the selected European countries has diminished among cancer causes of death (Kulzhanov and Rechel 2007). Kazakhstan show growing age-standardized mortality rates by main causes of death throughout the period under observation among the selected European countries. The novelty of this study is analysis of the mortality situation in Kazakhstan, which is less known, in comparison with the Czech Republic, France and Sweden, especially in cause-specific mortality.

1.4 Structure of the thesis

The presented thesis consists of ten chapters including introductory part and conclusion. In the first chapter the problem definition, research scheme, practical implementation of the research and the structure of it are outlined. The second chapter is focused on relevant literature and research publications as well as by many other available resources. The third chapter describes the theory of the "Epidemiological transition", defining its terminology, basic facts and development stages. The fourth chapter deals with research questions and also comprises the research hypotheses. The following chapter discusses and describes data availability and quality. It is also covers methods and the selected indicators for mortality analysis.

The following part of the thesis is devoted to presenting the most important research results. From the sixth chapter the analytical part of this research started. This chapter deals with the general mortality levels among the selected countries measured by life expectancy by age between the selected periods. The core analysis of this thesis is outlined in the seventh and eighth chapters, where the cause-specific mortality analysis and its changes over time are presented. Moreover, in the chapter seven the decomposition of life expectancy by age and main causes of death is shown. This part of analysis introduces the reader into the general mortality conditions among the selected countries: Kazakhstan, the Czech Republic, France and Sweden in the period of 1986-2008. The ninth chapter covers major risk factors of cancer sites. In the conclusion, the main findings of the research are recapitulated and discussed.

Chapter 2

Literature overview

Nowadays, there is a wide choice of literature related to the epidemiological literature focused on mortality. The theoretical and methodological conclusions and formulations presented in this thesis are based on several pieces of work done by demographers. For instance, A. Omran's (1971) theory of "Epidemiological Transition" describes the extraordinary advances in health care made in industrialized countries since the 18th century. Later Omran (1971, 1982) formulated his "Theory of the Epidemiological Transition", where he describes analysis and comparison of mortality patterns. Research works written by J. Olshansky and B. Ault (1986), R. Rogers and R. Hackenberg (1987) followed Omran's theory of epidemiological transition accepting the main concepts of the theory.

The research work by France Mesle (2002) "Mortality in Eastern Europe and the former Soviet Union: long-term trends and recent upturns" presents mortality trends in many countries of this region during the last thirty years. This study analyses the driving forces behind observed temporal changes. This paper reveals that from the middle 1960s to the late 1980s all countries experienced similar and unfavourable mortality trends due to rising mortality at adult age. However, in the 1990s these trends began to diverge in different parts of the region due to significant life expectancy increases in the central and eastern Europe and continuous life expectancy decreases in the former Soviet Union. The two contrasting trends were decomposed by causes of death, suggesting some causal mechanisms for the health crisis (Mesle 2002).

The theoretical view on the theme was formulated by various contemporary researchers such as C. M. Becker and D. Hemley (1998) with their "Demographic change in the former Soviet Union during the transition period". The given research examines patterns of mortality and other demographic changes across the former Soviet Union, and also describes the determinants of life expectancy and specific causes of death.

The mortality intensity in the post-communist countries was discussed by Nolte, McKee and Gilmore (2004) in their work "Morbidity and mortality in transition countries in the European context". In this research they examined the mortality in the countries of the former Soviet Union, they analyzed mortality patterns from the break up of the Soviet Union till the recent time. Also, they discussed the importance of specific risk factors to health in determining the patterns of morbidity and mortality in the transitional countries in central and eastern Europe and the countries of the former Soviet Union.

The next research work which focuses on mortality in the socialist area is Carlson and Hoffmans (2011) "The state socialist mortality syndrome" where the death rates in European socialist countries deviated from general improvements in survival observed. The magnitude of structural labor force changes across countries correlates with lagged increases in mortality intensity for men in the working ages. Occupational differences across these countries also show concentration of rising male death rates among workers. Collapse of state socialist systems produced rapid corrections in labor force structure after 1990, again correlated with a fading of the state socialist mortality syndrome in the following decades.

Unfortunately, there are few mortality studies from the Soviet period, in case of Kazakhstan it is 1980s time period. It is mainly due to the problems with publication of data as well as their low quality and inadequacy of mortality statistics. However, despite that some researchers analysed the dynamics of mortality by causes of death in post-Soviet region. This is exemplified by the collective work of F. Mesle, V. Shkolnikov, J. Vallin (1992) "Mortality by cause in the USSR in 1970-1987: the reconstruction of time series". The researchers reconstruct continuous annual series for the period 1970-1987 in spite of changes in cause of death classification caused by the 1980 revision of the Soviet coding system in this work. In addition, they analysed and described the main features of the evolution of mortality during the same period. In analysing part they used age-standardized mortality rates for several very important specific causes and methods of decomposition of life expectancy at birth changes.

There are some useful studies under the aegis of conceptual framework for explaining mortality crisis in transition period, such as "Mortality recovery and stabilization in Kazakhstan" (Becker and Urzhumova 2005). The scholars analyze the extraordinary rise in mortality intensity that accompanied economic deterioration in the former Soviet republic of Kazakhstan as well as the far more tentative recovery. Authors find out a large mortality disadvantage of working age males who were not of Kazakh ethnic origin, due to Kazakhstan's multi ethnic population. There are also stark regional differences - a mortality decline has been underway in many areas with a substantial economic recovery, while elsewhere there has been no significant improvement.

Little is known about health lifestyles in Central Asia, especially in Kazakhstan, where the downturn in life expectancy was also experienced. We would like to highlight the research work of W. Cockerham, P. Brian, and P. Abbott (2004) "Health lifestyles in Central Asia: the case of Kazakhstan and Kyrgyzstan". The purpose of this research paper is to fill a gap in the literature by examining health lifestyles in Kazakhstan and Kyrgyzstan, assessing its role in the mortality crisis.

Some research dedicated to the mortality patterns and trends was found in McKee, Healy and Falkingham's (2002) "Health care in Central Asia" and they endeavoured to describe the situation in the Central Asian republics after facing enormous challenges in embarking on health sector reform. This was due to their changing economic circumstances combined with the process of constructing new systems of government. The scientists have lack in information concerning health care systems in these countries and are not able to prove if these countries have made any attempts to improve their health systems in the nearest past time. On the one hand this literature disputes precisely this kind of cross-national health policy analysis. With the help of a systematic methodology, the experts and policy makers occupying different academic and administrative capacities tried to synthesize the available evidence on key health sector topics. The series seeks to contribute to the evolution, making approach to policy formulation in the health sector. Taking into account the advantages and disadvantages of various policy approaches, to promote the development of strategic responses which should be performed by health sector reform. On the other hand, this literature has less discussion of the cause-specific mortality conditions. However, analysis of the general mortality level among Central Asian region can be found (McKee, Healy and Falkingham 2002).

In the analysis of the cause-specific mortality in European countries, also the papers for whole region were used. Researchers such as Sans, Kesteloot and Kromhout (1997) "The burden of cardiovascular diseases mortality in Europe", Makinen's paper (2000) "Eastern European transition and suicide mortality", moreover, the paper of Dobrossy (2002) "Cancer mortality in central eastern Europe", Coleman et al. (2008) "Responding to challenge of cancer in Europe" and so on. The named research works are concentrated mainly on one disease for all European region, which is obviously advantage.

Concerning the mortality patterns in post socialist Central European countries a considerable amount of work has been conducted. The findings of J. Rychtarikova (2004) in "The case of the Czech Republic. Determinants of the recent favorable turnover in mortality" analyze from the period of the collapse of the socialist system at the beginning of the 1990s. It discusses how the health situation in the Czech Republic has improved more rapidly than in the other central and eastern European countries. Also, the recent decline in mortality is likely to be attributable to technical progress in medical treatment and less affected by the change in lifestyle. While the use of cardiovascular drugs and the number of operations of invasive heart surgery considerably improved (Rychtarikova 2004).

The research paper by La Vecchia et al. (2009) "Cancer mortality in Europe, 2000-2004, and an overview of trends since 1975" provides a comprehensive country by country overview of trends in mortality by cause within Europe from 1975 to 2004 using data from the World Health Organization.

Ferlay et al. (2007), in the article "Estimates of the cancer incidence and mortality in Europe in 2006", demonstrate very substantial differences between different EU states. In the chapter concerning mortality from different types of cancer, one can find discussion about the risk factors leading to changes in mortality.

The issue of mortality within demography still remains a very important factor in a population's development. The literature presented in this thesis is available from different sources. However, the articles and research papers on mortality development are not wide spread, especially on Kazakhstan, as a former Soviet Central Asian republic. The presented outline clearly indicates that there is a lack of research in the field of mortality development in Kazakhstan in comparison with the selected European countries, despite the vital importance of mortality process for population development within countries.

Chapter 3

Theoretical background

In order to provide a comprehensive theoretical framework for the analysis of mortality, it is necessary to review the theories used in this field. In the case to distinguish stages of life, which could be characterized by different levels of intensity as well as different causes of deaths the theory of epidemiological transition is a classical theory. Demographers such as Omran (1971), Philips (1994), Caldwell (2001) well described the basic principles of epidemiological transition and its relation to the demographic transition in the 20th century. Omran explains the evolution of life, indicating the possible determinants of change. The basis of the classical model of epidemiological transition has been the evolution of mortality in European countries. Currently, the concept of epidemiological transition in the expansion of its interpretation can be considered as the basic theoretical model that explains the demographic change in morbidity and mortality.

The theory of epidemiological transition deals with the changes in patterns of health and disease, and focuses on the interactions between demographic, economic, and sociologic determinants of these patterns. An epidemiologic transition is still underway in less developed societies, and in the developed countries combine technological and demographic transitions. The primary causes of morbidity and mortality are man-made diseases (Weisz and Olszynko-Gryn 2009).

Demographic factors of mortality traditionally divided into two groups: endogenous (inherited diseases, natural aging, birth defects and other factors due to biological characteristics of the human body and its heredity) and exogenous (related to the influence of the environment: accidents, injuries and poisoning, infectious and parasitic diseases, acute respiratory system, digestive diseases and other diseases). According to the theory of epidemiological transition, the demographic situation has radically changed. In particular, that the structure of mortality by causes of death, detailed changes in the prevalence of exogenous causes of death become the primacy of endogenous causes of death. The effect of these changes is that some specific factors affect the health and life of people directly, regardless of their level of welfare (Omran 1971). This is particularly true when considering new sanitary and hygienic conditions. Moreover, a new role for medicine resulting from industrial development and related scientific, technological and cultural progress, as well as some of the changes eco-biological conditions.

All the above mentioned factors dramatically reduce deaths from epidemic and other infectious diseases which have taken millions of lives in the recent past. Simultaneously, this led to an increase in the proportion of people dying from diseases of the circulatory system and neoplasms. This radical change to the structure of mortality is called epidemiological transition.

In accordance with the role of reasons, the causes of death are divided into the following stages of epidemiological transition proposed by Omran:

1. The stage before the transition, the period of epidemics and starvation, which is characterized by high levels and fluctuations in mortality. During this period, life expectancy is low and ranges from 20 to 40 years. The conditions for the life of individual are not proper, thus life expectancy at birth is very low, and the leading causes of death are infectious and parasitic diseases, such as influenza, diarrhea and tuberculosis.
2. The transition stage, which is much more positive, than the previous one. The pandemia and fluctuations are rather rare, occasional, and they do not cause such great mortality. Thus birth rate is rising and other life indicators improve, the epidemics become less frequent and recede. Life expectancy at birth is about 30-50 years. As a result, an increasing number of people no longer die from infectious at young ages, but from chronic degenerative diseases at middle and older ages. However, the second stage rises in morbidity and mortality from endogenous causes, such as diseases of the circulatory system and neoplasms. They then move on to an increasingly young age. Increased levels of population, psychological and physical stress may have contributed to this, however it is not certain. At the same time increasing mortality from accidents, especially in manufacturing was observed.
3. The stage after the transition, where population naturally grows because the main causes of mortality are degenerative. In this case natality is the main factor of population growth and it can strongly influence this indicator. The period of degenerative and occupational diseases, characterized by a further decline in mortality, which is stabilized at a relatively low level. In addition, life expectancy at birth increases and exceeds 70 years by the end of the third stage. The major causes of death are so-called chronic degenerative and man-made diseases, cancer and diabetes. The term “man-made diseases”, hereby, includes diseases related to radiation, accident, food additives, occupational hazards, and environmental pollution. Then the struggle for environmental protection and improvements to the living conditions of people begins. Their work and life conditions are one of the main criteria for the development of new technology, which can minimize threats to the health and lives of people. More and more people have begun to live a healthy lifestyle, get rid of bad habits, exercise, eat correctly and generally follow reasonable hygiene guidelines. Further medical progress in the prevention not only reduces the incidents, but also mortality from many causes. As a result, life expectancy increases, as the average expected age of death from most diseases increases (Omran 1971, pp.509-538).

What should be retained from this schematic picture formulated in the early 1970s, not a lot, according to the demographer John C. Caldwell; who wrote, “What happened in the mortality transition was the conquest of infectious disease, not a mysterious displacement of infection by degeneration as the cause of death. The resulting demographic transition with its changing age of death and the existence of large numbers of people afflicted with chronic degenerative disease (rather than life-threatening infectious disease) is important for planning health services and medical training, which is the current focus of the burden of disease approach" (Caldwell 2001, pp.159-170). Other criticisms of Omran's account are that he suggested that the mortality decline would stop during the third stage and that the epidemiological transition is universal, even if delayed for less-developed countries.

The research work of J. Olshansky and B. Ault (1986) was followed by scholars: R. Rogers and R. Hackenberg (1987). J. Olshansky and B. Ault (1986) presented in their works the fourth stage, while Omran presented only three stages, where the achievements in the treatment of CVD, would increase the life expectancy, thanks to the cardiovascular revolution of the 1970s, which launched a new period of progress. The period of delayed degenerative diseases, during that period, they remain the same as actual disease, which defines the third stage of epidemiological transition, but deaths from them come in much older age groups, while at the young age, mortality is low. There is a rapid decline in old age groups and mass deaths are transferred to the most senior age. As a result, the life expectancy at birth continues to rise, although not as strongly as in the early stages of epidemiological transition.

It can be assumed that the fourth stage began only recently, which is typical for countries with low mortality and higher life expectancy. At this stage there is a further reduction in mortality from endogenous causes markedly improved prevention and treatment of congenital disease associated with genetic disorders and congenital abnormality of fetal development. Infant and adolescence mortality continues to decline as a sign of an explicit medical progress, and mortality among the elderly is becoming less visible, which is caused by an aging progress. It is about promoting lifestyles that help to reduce the risk mortality of non-infectious origin, especially cardiovascular diseases and cancer. Rational diet (with the reduction of fat and calories in particular), enough sleep and exercise, give up smoking and moderation in alcohol consumption - these healthy habits should lead to the lengthening of life expectancy (Gaylin and Kates 1997).

Olshansky and Ault have called the fourth stage the "Age of delayed degenerative Diseases" which they see as a stage that will propel life expectancy into, and perhaps beyond, the eighth decade. The major degenerative causes of death that prevailed during stage 3 of the transition remain as major killers, but with relatively rapid improvements in survival concentrated among the older population (Smallman-Raynor and Phillips 1999).

Rogers and Hackenberg (1987) also put forward a fourth stage of the epidemiological transition. They agree with Olshansky and Ault (1986) that the major causes of death are still due to degenerative and man-made diseases. Each is becoming increasingly influenced by individual behaviour and new lifestyles, influences not concretely addressed in the present theory. The point they stress the most is the fact that Omran did not include violent deaths in his theory, or deaths due to social pathologies (such as accidents, suicides and homicides).

Ecological and biological determinants of mortality indicate the existence of a complex balance between the pathogens and the level of adverse conditions in the environment and resistance of the host organism. The political, socio-economic and cultural determinants incorporate well-being, sanitary conditions and nutrition. Hygiene and diet are included in this group, but not in the category of health determinants. The reason for that was improvement of sanitary conditions and diet in Western countries as a consequence of social change, rather than targeted measures in the field of medicine (The World Bank 1993). Health determinants and the determinants of public health include specific measures of preventive and curative nature, used to combat diseases. These include sanitation, safety, vaccinations and effective therapeutic measures.

Many countries had not experienced the cardiovascular revolution, and even more a lot of them, especially in Africa, have not completed the second phase of the epidemiological transition, and struggling with new epidemics such like AIDS, or the resurgence of older diseases (Caselli et al. 2002).

Mortality from accidents and other external causes are also on high levels, mainly due to alcoholism (McKee et al. 1998). In the Soviet Central Asian countries one of the major theories that complete today in the stress related explanation of the upsurge in mortality is the increase in alcoholism (Leon et al. 1997). The major alternative explanation attributes the rise in mortality to the increased consumption of alcohol that really occurred in the early 1990s according to above mentioned authors in the late 1980s, during the anti-alcoholic campaign, according to unofficial estimates.

Mortality by all causes of death in the post-communist countries rose and the exception was an increase in mortality from causes other than infectious one. The variations among the republics conform broadly to expectations that mortality from infectious, digestive and respiratory system disease is the highest in the less-developed Central Asian republics. Theoretical framework, which could explain mortality differences between regions usually, incorporate other factors such as medical care based on differences in access and quality of medical care. Environmental pollution: also causes certain diseases in various areas. However, it is mainly the socio-economic situation and education which enforces healthy behaviour, while wealth gives a higher quality of life. Economic affluence permits that the implementation of these factors are influenced by psychological stress which may cause excess mortality (Bobak and Marmot 1996).

The patterns of diseases that prevail in Central Asia today suggest that the countries have yet to pass completely through the epidemiological transition, and that some disorders that had previously been eradicated have seen a resurgence. Furthermore, in some Central Asian countries such as Turkmenistan and Tajikistan, classical pre-transitional disorders such as acute respiratory infections and diarrheal diseases cause high infant mortality, indicating that they have never been completely suppressed in these areas (Klugman and Schieber 1996).

Taking into account strong and weak points of the epidemiological transition concept, we have to emphasize, that primary success in the struggle against mortality during the first epidemiological transition has been made thanks to mass prevention activities for human health and life. Possibilities of the former strategy for reducing mortality have been exhausted with the completion of the first epidemiological transition. The new reduction in mortality occurred otherwise. Humanity has come to the second stage of transition, when it took out a new strategy, a new type of prevention aimed at reducing the risk of death from diseases of non-infectious origin, particularly cardiovascular diseases and neoplasms, as well as from accidents, violence and other similar reasons directly related to diseases. This strategy required more active and conscious attitude towards their health by everyone, so much great material costs for the protection and restoration of health, which in turn has helped to increase its social value. Negative events of the last two stages can be called an accelerated growth of chronic and congenital diseases associated with genetic disorders (Gaylin and Kates 1997).

Chapter 4

Research questions and hypotheses

The research contrasts the cause-specific mortality levels in Kazakhstan with the selected European countries - the Czech Republic, France and Sweden. The goal of this thesis is to assess cancer mortality trends in Kazakhstan, using the data taken from WHO MDB, through detailed descriptive analysis of cancer mortality changes observed in comparison with the selected European countries, during the period 1986-2008. To achieve the goal of the thesis the following research questions were defined:

1. What is the development of life expectancy and its age and sex patterns in Kazakhstan and in the selected European countries?
2. What are the differences in mortality by age, sex, causes and how did these patterns change during the period of under observation?
3. What are the mortality development of cancer in comparison with infectious, circulatory, respiratory, digestive, external and other causes of death?
4. What is the difference between Kazakhstan and the selected European countries in mortality development of the selected malignant neoplasms ?
5. What is the most prevailing type of cancer among other frequent form of neoplasms in mortality development of the selected countries?
6. What are the most vulnerable age-groups among males and females affected by neoplasms?
7. What are the major risk factors contributing to the development of mortality from malignant neoplasms?

Regarding to the cause-specific mortality analysis in the selected countries, the following hypotheses will give a guideline through the study.

1. Kazakhstan has the lowest level of life expectancy at birth among the selected countries in both sexes. It can be mainly due to the economic crisis, low level of medicine, ecological situation, dissatisfaction with life, lifestyle factors, etc.
2. Neoplasms together with circulatory diseases and external causes of death belong among leading causes of death in Kazakhstan and in the selected European countries; their importance to the overall intensity of mortality increases with time.

3. Due to cancer causes and risk factors in the selected countries the leading cancer site is MN of trachea, bronchus and lung among males and MN of breast is among females.
4. Recent changes in mortality trends indicate that many European countries have made significant progress in the fight against circulatory diseases, while malignant neoplasms remain a serious problem. When the described development continues, we can expect that these types of diseases will become the leading and the most frequent cause of death among males and females in the majority of the European Union countries.

Chapter 5

Data and methods

5.1 Data sources and their quality

The mortality data (number of deaths by age, sex and causes of death in the age interval from 0 to 85+) were extracted from (WHO MDB, http://www.who.int/whosis/mort/download/en/ index.html); it provides annual reported data on mortality statistics by age, sex and cause of death as obtained from civil registration systems in given countries. The data available on the WHO MDB comprise deaths registered in national civil registration systems, with underlying cause of death as coded by the relevant national authority. Underlying cause of death is defined as "the disease or injury which initiated the train of morbid events leading directly to death, or the circumstances of the accident or violence which produced the fatal injury" in accordance with the rules of the International Classification of Diseases (ICD) (WHO MDB 2012). Data comprising population (mid-year population by age and sex in the age interval from 0 to 85+) were also extracted from the WHO MDB. Each Member State reports population data along with their mortality data, for the population covered by the death registration system. Where this is a subset of the national population, the data is labelled accordingly in the WHO Mortality Database. However, the completeness of death registration may also be less than 100% for the specified registration population.

Eurostat Database was also used to complete some missing population data (http://epp.eurostat.ec.europa.eu/portal/page/portal/population/data/database) (Eurostat 2012). During the data extraction problems were found in France, data comprising population in both sexes in 2008 are not available. Mid-year population was obtained by calculating the arithmetic mean of population at the beginning of the year and at the end of the year. Data for malignant neoplasm of female breast in 1992 are not available for Kazakhstan.

The selection of the most appropriate period (1986–2008) for the analysis was carried out on the basis of the same time availability of data for the compared countries in the WHO database.

In this study we also used the European Health for All Database (HFA-DB online version) (http://data.euro.who.int/hfadb/); to extract data which were used in the chapter, concerning cancer causes and risk factors. It covers the main demographics, health determinants, status and risk factors in the 53 Member States in the WHO European Region. The data are compiled from various sources, including WHO/Europe's technical programmes and partner organizations, such as agencies of the United Nations system, the statistical office of the European Union (Eurostat) and the Organization for Economic Cooperation and Development. With the help of HFA-DB online version one can make country, intercountry and regional analyses. Two times in a calendar year the above mentioned Database is updated (WHO 2012).

We should be aware that there can be some inaccuracy in data gathered by statistical offices. Following the conclusions made by Barbara A. Anderson and B. Silver (1997, p.157): "Mortality data taken from the Central Asian region, especially for males, are considered to be of unsatisfactory quality, it is based on assessment on the anomalies in the age patterns of mortality in the data from this region, where as we know is the geographical location of Kazakhstan. These anomalies include higher mortality rates in urban areas than in rural ones". In general the authors state that despite possible recent improvements in the quality of mortality data from Central Asia, the health situation there is likely to be worse than it appears from official statistics. It is due to many important causes of misreporting, which usually limit analysts' ability to identify relevant mortality trends and their differences.

Another problem related to data quality arises from the existence of the different set of definitions applied to the components of the infant mortality rate, which is one of the most well-known features of the former USSR demographic statistics. The standard international definitions of the UN and the WHO consider as live births infants who exhibit some sign of life upon delivery. In contrast the Soviet definition only counts breathing as a sign of life; infants under 28 centimetres in length and with weight less than 1000 grams who died within the full seven days of life were excluded from both: the number of live births and infant deaths, they were considered as miscarriages, and not counted at all (Aleshina and Redmond 2003).

Table 1: Soviet and WHO definitions of live birth

<table>
<tr><td rowspan="2"></td><td colspan="4">Infant born after the end of the 28th week of pregnancy</td></tr>
<tr><td>No signs
of life</td><td>No breath but
other signs of life</td><td>Died during
the first 7 days</td><td>Survived
the first 7 days</td></tr>
<tr><td>USSR</td><td colspan="2">Stillbirth</td><td colspan="2">Livebirth</td></tr>
<tr><td>WHO</td><td>Stillbirth</td><td colspan="3">Livebirth</td></tr>
<tr><td rowspan="2"></td><td colspan="4">Infant born before the end of the 28th week of pregnancy,
or with weight under 1,000 gr. or length under 35 cm</td></tr>
<tr><td>No signs
of life</td><td>No breath but
other signs of life</td><td>Died during
the first 7 days</td><td>Survived
the first 7 days</td></tr>
<tr><td>USSR</td><td colspan="3">Miscarriage</td><td>Livebirth</td></tr>
<tr><td>WHO</td><td>Stillbirth</td><td colspan="3">Livebirth</td></tr>
</table>

Source: Anderson and Silver (1986)

Table 1 presents detailed differences in Soviet and WHO definitions of live births and stillbirths (Anderson and Silver 1986). These differences cause significant misunderstanding of the infant mortality rates in official Soviet statistical sources relative to the rates obtained for countries that stick the international standards. A live birth as it is currently defined may reduce the infant mortality count. Misreporting, for example the reclassification of infant deaths as stillbirths has increased throughout the 90s. In some countries, deaths of older infants may be recorded as deaths of children aged over one year. Besides, the registration of births and infant deaths is less than complete, because unregistered births and deaths are not included in official statistics. Most of these hard evidence pertain to countries of the former USSR, Kazakhstan was one of them (Aleshina and Redmond 2003).

In addition, the use of data published by international organizations does not guarantee that it is accurate because data processing also depends on the data collection methods within a particular country or region. Table 2 contains more recent data, but again one can see the difference from official data, which is underestimated infant mortality. We can conclude that the accuracy of official data has not improved, and estimation of infant mortality level had even worsened.

Table 2: Official infant mortality rate (per 1,000 live births) and survey based estimates

	Official rate (2001)	**Survey estimate**	**Survey name and year**	**Years of survey estimate**	**Average official rate for corresponding years**	**Absolute difference (survey estimate less official rate)**
Kazakhstan	19	40	DHS 1995	(1991-1995)	27	13
		62	DHS 1999	(1994-1999)	24	38

Notes: DHS - Demographic health survey

Source: Aleshina and Redmond (2003)

Data quality is a much more complex issue for causes of death than for mortality levels in the Central Asian region. Researchers conclude that the problem that plagues the causes of death analysis in the Newly Independent States (NIS) is that the cause of death classifications in the USSR changed over time, and the latest classification is different from the standard 9th revision of the ICD (Aleshina and Redmond 2003). As Bobadilla et al. (1997) suggests this problem becomes significant for some specific causes of death, such as cardiovascular diseases. Other researchers address this incompatibility and adjust the classifications to provide a comprehensive review of trends (Mesle, Shkolnikov and Vallin 1992). They also describe quality of data by causes of death in the former Soviet Union. They find out that in many cases, sources of error compensate each other (Bobadilla et al. 1997). One of the most curious findings is that the results do not support the widespread opinion about an over registration of cardiovascular mortality. Indeed, large errors observed for different cardiovascular diseases compensate each other; consequently, the percentage of error for the total number of CVD is rather small (Mesle, Shkolnikov and Vallin 1992). Unfortunately, some countries are not able to ensure complete registration of all death cases and births, such misreporting often takes place in Kazakhstan, where relatives of deceased person of working age have not incentives to report such deaths, because they become eligible for survivors' benefits from the state solidarity pension system. In some cases relatives have incentive not to report death facts. In the life expectancy calculations using incomplete mortality data the results could be higher than they actually are (Becker and Urzhumova 2005).

The study analyses mortality data classified according to the abbreviated eighth, ninth and tenth revisions of the International Classification of Diseases (Table 3). The ICD is the international standard classification which is used not only in clinical purpose, but also for all general epidemiological and health management purposes. These include the characteristics and circumstances of the individuals affected, reimbursement, resource allocation and quality.

The changes made in the revisions of the ICD can cause obstacles to perform analysis. The 10th revision was adopted in 1990 by the World Health Assembly and came into effect as from 1993. The number of countries submitting their underlying causes of death data to WHO using the ICD 10th revision has increased from 4 in 1995 to 75 in 2003 and to over 100 in 2007 and there are still around 10 countries reporting data using the 9th revision of the ICD (WHO ICD 2012). Since 1981 till 2003 the 9th revision of the ICD has been used in Kazakhstan. In comparison, most of Central Asian countries still use ICD-9 classification. As it can be seen from the Table 3, the Czech Republic and Sweden adopted ICD-10 classification in 90s, France in 2000 and Kazakhstan adopted it only in 2004. Ideally, to fill in the breaks in the statistical series due to changes in the cause of death classification, a precise reconstruction method should be applied (Mesle et al. 1992; Mesle and Vallin 1996). However, such a time-consuming method can be replaced by a rough grouping of classification items that make it possible to capture major changes in cause-specific mortality by dealing with very broad groups of causes.

Table 3: Data availability according to ICD revisions from 1986 to 2008, in the selected countries

Country	Code	ICD 8	ICD 9	ICD 10
Kazakhstan	4182	N/A	1986-2003	2004-2008
Czech Republic	4045	N/A	1986-1993	1994-2008
France	4080	N/A	1986-1999	2000-2008
Sweden	4290	1986-1986	1987-1996	1997-2008

Note: N/A = not applicable

Source: WHO MDB (http://www.who.int/healthinfo/morttables/en/)

5.2 International classification of diseases

In the very beginning of modern statistics (right after the foundation of systematic vital event registration) the classifications of causes of death were in the competence of respective administrative authorities and usually comprised short simple list of the most frequent epidemic diseases and accidents. In the 19th century this has changed with the new advances of statistics. The history of the classification of diseases, as we know it nowadays under the initials ICD used for the International Classifications of Diseases, began in 1853 (WHO ICD 2012).

The International Classification of Diseases, published by the WHO, is designed to promote international comparability in the collection, processing, classification, and presentation of morbidity and mortality data. It is the international standard diagnostic classification for all general epidemiological purposes, many health management purposes and clinical use. It is used worldwide to classify diseases and other problems recorded on many types of health and vital records, including death certificates and health records. In addition to enabling the storage and retrieval of diagnostic information, these records provide the basis for the compilation of national mortality and morbidity statistics by WHO member states (WHO ICD 2012).

For the entire study period (1986-2008) three different revisions (ICD-8, ICD-9 and ICD-10) were used. The ICD is a basic normative document, which is used worldwide not only by demographers, but by medics and other researchers. The publication consists of three volumes, with instruction, classification and index included. The systematic recording, analysis, interpretation and comparison of mortality data, obtained in different countries and at different times are the main goals achieved with the help of the ICD. The idea of developing the ICD was due to necessity of more efficient storage and retrieval of diagnostic data. The 8th revision of the ICD was convened by WHO in 1965, this revision has the basic structure of the Classification and the main philosophy of classifying diseases, according to their etiology. During the period that covers 8th revision of the ICD rapidly increased indexing hospital medical records and some countries prepared national adaptations providing the additional detail needed for this application of the ICD. The 9th revision of the ICD was convened by WHO in 1975 (WHO ICD 2012). The benefit was to make it more relevant for the estimation of medical care, not just underlying generalized disease, but dealing with classified conditions to the chapters concerned with affected part of the body. This system became well-known as the dagger and asterisk system and it is retained in the 10th revision of the ICD. Due to new discoveries in medical science, many improvements have been made to the coding of the 10th revision. In comparison with the previous revisions the ICD-10 code involves more detailed and expanded concepts for injures, laterality, and other related factors.

Although the International Classification of Diseases is intended to provide a standard way of recording underlying cause of death, comparison of cause of death data over time and across countries should be undertaken with caution. Several new features and changes from ICD-9 to ICD-10 have great impact on the interpretation of the statistical data. The implications of these changes in ICD-10 should be taken into account when making trend comparisons and estimates for causes of death. ICD-10 is more detailed with about 10,000 conditions for classifying causes of death compared to around 5,100 in ICD-9. The complexity of ICD-10 provides a lot of benefits because the level of details conveyed in the codes is increased. The rules for selecting the underlying cause of death have been re-evaluated and sometimes changed. Accuracy in diagnosing causes of death still varies from one country to another. In addition the process of coding underlying causes of death involves some extent of misattribution or miscoding even in countries where causes are assigned by medically qualified staff. Main reasons are incorrect or systematic biases in diagnosis, incorrect or incomplete death certificates, misinterpretation of ICD rules for selection of the underlying cause, and variations in the use of coding categories for unknown and ill-defined causes (WHO ICD 2012).

When analysing past trends it is important to allow for changes introduced when the ICD coding changes. For example, significant changes between ICD-9 and ICD-10 include a change in the format of the code, an expansion of the number of codes used, a movement of some diseases and conditions between broad groups and changes to the rules governing the selection of the underlying cause of death, which has had a large effect. The death certificate recommended by the WHO has two parts. Part 1 gives the condition or sequence of conditions leading directly to death; Part 2 gives details of any associated conditions that contributed to the death but are not part of the causal sequence (Ridsdale and Gallop 2010).

The selection of the cause of death is defined by WHO as the disease or injury that initiated the train of events directly leading to death or the circumstances of the accident or violence that produced the fatal injury. (WHO MD 2012) Changes in practice within ICD can be substantial as can changes in “fashion” in coding over time. International comparisons are particularly problematic because of different conventions about coding within WHO MDB. For example, (see Table 4) in ICD-10 Kazakhstan uses "1000" as the code for all causes, while other selected countries use "AAA" as the code for the same cause of death. Nevertheless not taking into account the differences in all revisions, our main aim is to achieve qualitative results through the right sort of data.

Table 4: ICD and WHO MDB codes of main groups of causes of death and major neoplasms according to the revisions of ICD

Causes of death	**ICD-8 Codes**		**ICD-9 Codes**		**ICD-10 Codes**	
	ICD codes	**WHO MD codes**	**ICD codes**	**WHO MD codes**	**ICD codes**	**WHO MD codes**
1. All causes		A000		B00	1000	AAA
2. Circulatory diseases	390-458	A080-A088	390-459	B25-B30 (CH07)	1064	I00-I99
3. Neoplasms	140-239	A045-A061	140-239	B08-B17 (CH02)	1026	C00-D48
3.1 Malignant neoplasms	140-209	A045-A060	140-208	B08-B14 (S08)	1027-1046	C00-C97
3.1.1 MN of prostate	185	A057	185	B124	1040	C61
3.1.2 MN of larynx	161	A050	161	B100	1033	C32
3.1.3 MN of lip, oral cavity and pharynx	140-149	A045	140-149	B08	1027	C00-C14
3.1.4 MN of trachea, bronchus and lung	162	A051	161-162	B101	1034	C33-C34
3.1.5 MN of colon, rectum and anus	152-154	A048-A049	153-154	B093-B094	1030	C18-C21
3.1.6 MN of oesophagus	150	A046	150	B090	1028	C15
3.1.7 MN of lymphatic and haemopoeitic tissue	204-209	A059-A060	200-208	B14	1043-1045	C81-C96
3.1.8 MN of stomach	151	A047	151	B091	1029	C16
3.1.9 MN of female breast	174	A054	174	B113	1036	C50
3.2 Other neoplasms	210-239	A061	210-239	B15-B17 (S15)	1047	D00-D48
4. Respiratory diseases	460-519	A089-A096	460-519	B31-B32 (CH08)	1072	J00-J98
5. External Diseases	E810-E999	A138-A150	E800-E999	B47-B56 (CH17)	1095	V01-Y89
6. Digestive diseases	520-577	A097-A104	520-579	B33-B34 (CH09)	1078	K00-K92
7. Infectious diseases	000-136	A001-A044	001-139	B01-B07 (CH01)	1001	A00-B99

Source: WHO MDB classifications (http://www.who.int/classifications/icd/en/)

According to the selected countries four different causes of death code description tables were used. Table 4 illustrates ICD and WHO MDB codes of selected causes of death for all selected countries in taken time period 1986-2008. This list of codes for the selected causes of death was taken from the basic tabulation list and the special coding for some Newly Independent States of former USSR in the ninth revision. We must mention that according to the code descriptions of cause of death, which was presented by WHO, codes in case of Kazakhstan for calculation of mortality intensities from Basic Tabulation List Table 6 of ICD-9 and Mortality Tabulation List 1 of ICD-10 were used. Codes for the other selected countries used ICD-8, ICD-9 and ICD-10 detailed third and forth character.

In this thesis, we first analyzed the main groups of causes of death (Table 4): circulatory diseases, neoplasms, respiratory diseases, external diseases, digestive diseases, infectious diseases, and the remaining other causes of death. The principle of cause-specific mortality analysis arises from general diseases to partial one. That's why, first we analyse main groups, which represent a great proportion in mortality structure in comparison with other causes of death; than taking only neoplasms, make thoroughly analysis on its parts, primarily the most frequent malignant neoplasms.

There are a lot of types of neoplasms, more than 100, that is why it is important to sort them by the most dangerousness and prevalence among the selected countries. Neoplasms are subdivided into 2 groups: malignant neoplasms, and benign neoplasms (marked in Table 4 as Other neoplasms), which are slow growing and do not spread. Usually these tumors are innocuous if they do not influence on the function of nearest tissue. As we can see from Table 4, we selected the most important groups of malignant neoplasms, which are often occurs among human beings and have significant values among other types of cancer: MN of prostate (only males), MN of larynx, MN of lip, oral cavity and pharynx, MN of trachea, bronchus and lung, MN of colon, rectum and anus, MN of oesophagus, MN of lymphatic and haemopoeitic tissue, MN of stomach and MN of female breast.

Some of these sites include two or more distinct cancer types with different epidemiologies and implications, for example colorectal cancer, which comprises both colon and rectal cancers; malignant neoplasm of oesophagus, which comprises both squamous cancer of the upper and middle third and adenocarcinoma of the lower third; malignant neoplasm of lip, oral cavity and pharynx; and malignant neoplasm of trachea, bronchus and lung (Cancer.net 2012).

5.3 Adopted approaches and methods used

In order to capture important trends in the selected countries in the period under observation, selected mortality indicators were used: the life expectancy at exact age, age-standardized mortality rate, age-specific death rate, infant mortality rate, decomposition of life expectancy at birth, and years of potential life lost. Some of the indicators are based on abridged life tables by sex and five-year age-group.

Life tables are the most ancient and important tool in demography. They are widely used for descriptive and analytical purposes in demography, public health, epidemiology, population geography, biology and many other branches of science (Max Planck Institute for Demographic Research 2007). Life tables are usually constructed separately for males and females, because of their substantially difference in mortality rates. For a more detailed description of life tables and methods for their construction, see the textbooks by Preston, Heuveline, Guillot (2001), and Bell, Miller (2002).

In order to calculate life expectancy, the probabilities of death between the exact ages of x and $x+n$ were calculated using so-called indirect method of calculation:

$$ {}_nq_x = \frac{2 * n *_n m_x}{2 + n *_n m_x} $$

where: n is a length of age group, ${}_n m_x$ is age-specific death rate, ${}_n m_x = \frac{{}_n D_x}{{}_n P_x}$, where ${}_n D_x$ is the number of deaths in a year, and ${}_n P$ is the number of persons in a population at midyear.

The most important indicator of mortality intensity is the life expectancy at exact age. The life expectancy at birth is the average number of years a newborn could expect to hypothetically live, notably if he or she were to pass through life subject to the age-specific death rates of a given period (IUSSP, 1982). It is calculated as a weighted average of the age of a cohort of 100,000 newborn subjected to different age-specific death rates. Data on population sizes for different age groups and the number of deaths in those groups at the middle of the year is required. In general, several steps are needed to derive life expectancy from age-specific death rates using the life (mortality) table.

The average number of years of life remaining at exact age *x* is calculated as follows:

$$e_0 = \frac{T_0}{l_0}$$

where: l_0 is number of persons alive at exact age *x*. T_0 is an auxiliary indicator which expresses the number of years of life to be lived by the table generation (not of an individual) at a given age (Bell and Miller 2002).

To eliminate the influence of age structure on values of crude death rates, the direct standardization method was used. There are two types of the standardization method - direct and indirect. They eliminate the differences in the age composition of the population and therefore more accurately reflect to the relative levels of mortality in the spatial and temporal comparisons. Based on the foregoing, the direct method of standardization is especially useful when comparing the death rates by cause of death, as the standardized mortality rate from a group of causes of death is the sum of the standardized mortality rates from each of the causes of the group. For comparison of overall mortality rates using direct standardization is necessary to calculate the number of deaths that could be recorded in this population if the age composition of the population coincided with the age composition of the population-standard. The direct standardization can be used in the study of a sufficiently large population, where age-specific factors in the population are stable and consistent. It should be noted, when the population is small, then the number of events in the target population can also be small. In contrast to direct standardization, indirect method is highly reliable in context of small population. Therefore, analyzing data of selected countries by direct standardization is most suitable. The formula for age-standardized mortality rates (ASMR) can be expressed as:

$$ASMR = \frac{\sum (m_x * P_x^s)}{P_x^s} * 100{,}000$$

where: m_x is the age-specific death rate at age *x*. P_x^s is the number of people at age *x* (age group) in the standard population. P^s is the total standard population. During the calculation in this thesis WHO Old European standard population was selected.

In other words, the age-standardized mortality rate is a weighted average of the age-specific death rates per 100,000 persons, where the weights are the proportions of persons in the corresponding age groups of the WHO standard population.

For analysis of differences in life expectancies at birth, we used Pollard's (1988) two-dimensional method of decomposition:

$$e_0^2 - e_0^1 = \sum_{\xi=0}^{85+} \left[({}_n m_x^1 - {}_n m_x^2) * w_{xs} * n \right]$$

where: ${}_n m_x^1$ and ${}_n m_x^2$ are mortality rates by causes of death of population 1 and 2 in age group x and $x+n$.

w_{xs} is a weight of average future years lived beyond age x that tells how much influenced the mortality rate deferential,

$$w = \frac{1}{2} * \left[(\frac{l_\xi^2 + l_{\xi+n}^2}{200000} * \frac{e_\xi^1 + e_{\xi+n}^1}{2}) + (\frac{l_\xi^1 + l_{\xi+n}^1}{200000} * \frac{e_\xi^2 + e_{\xi+n}^2}{2}) \right]$$

where: l_ξ^2, l_ξ^1 and $l_{\xi+n}^2, l_{\xi+n}^1$ is a table number of persons alive at exact age ξ and $\xi + n$ from mortality tables of population 1 and 2.

e_ξ^2, e_ξ^1 and $e_{\xi+n}^2, e_{\xi+n}^1$ is a expectation of life at exact age ξ and $\xi + n$ from mortality tables of population 1 and 2.

For calculation of the weights of exact age 0, was used the following formula:

$$w_{0.5} = \frac{1}{2} * \left[(\frac{0.9 * l_0^2 + 0.1 * l_1^2}{100000}) * (0.9 * e_0^1 + 0.1 * e_1^1) \right]$$

$$+ (\frac{0.9 * l_0^1 + 0.1 * l_1^1}{100000}) * (0.9 * e_0^2 + 0.1 * e_1^2)$$

The decompositions are made separately for each country, by sex, so that comparisons may be made in the age and sex pattern of contributions to e_o over time and as well as between the selected European countries and Kazakhstan for 2008 during the period of 1986-2008. The sum of contributions of all age groups equals to the total difference observed in life expectancy at birth between two populations.

Another indicator used in the thesis is Years of potential life lost (YPLL); it is an alternative measure that highlights premature, preventable, and unnecessary mortality. Several of different calculations for YPLL can be applied, each has a slightly different emphasis. The method of calculating YPLL varies from author to author, each producing different rankings of leading causes of premature death. One can choose between heart disease, cancer or accidents as the leading cause of premature death, depending on which method is used. Confusion in the use of this measure stems from a misunderstanding of the value system inherent in the calculation, as well as from differing views as to values that should be applied to each age at death. In this thesis we use the YPLL calculation, which is easily understood.

In general, YPLL represents the total number of years not lived by an individual who died before age 75 (General Health Status 2011). This indicator gives more importance to the causes of death that occurred at younger ages than those occurred at older ages. The upper age limit of 75 is used to approximate the life expectancy for both sexes combined. For example, an individual in good health is expected to live up to age 75 in all of the selected countries. Deaths occurring in persons at age 75 or older are not included in the calculation. Infant deaths are included in the calculation due to their very small numbers. Other methods exclude these deaths since they are often due to causes that have different etiology from deaths at later ages.

YPLL is calculated for each age group (0, 1-4, 5-9, …, and 70-74) by multiplying the number of deaths by the difference between age 75 and the mean age at death in each age group. Years of potential life lost correspond to the sum of products obtained for each group. YPLL is obtained by dividing sum of YPLL by the total population under 75 years old (Working Group on Community Health Information Systems 2006).

Table 5: Description of the procedure for calculating Years of potential life lost

Age	**Number of Deaths (1)**	**Mean Age at Death (2)**	**75 - Mean Age at Death (3)**	**YPLL = (1) x (3)**
0	4	0.5	74.5	298.0
1-4	28	3.0	72.0	2,016.0
5-9	52	7.5	67.5	3,510.0
10-14	64	12.5	62.5	4,000.0
15-19	315	17.5	57.5	18,112.5
20-24	410	22.5	52.5	21,525.0
25-29	308	27.5	47.5	14,630.0
30-34	243	32.5	42.5	10,327.5
35-39	171	37.5	37.5	6,412.5
40-44	131	42.5	32.5	4,257.5
45-49	116	47.5	27.5	3,190.0
50-54	85	52.5	22.5	1,912.5
55-59	85	57.5	17.5	1,487.5
60-64	86	62.5	12.5	1,075.0
65-69	64	67.5	7.5	480.0
70-74	70	72.5	2.5	175.0
SUM of YPLL				**93,409**

Source: Working Group on Community Health Information Systems, Community Health Indicators-Definitions and Interpretations, Ottawa, Ontario: Canadian Institute for Health Information. (http://www.apheo.ca/index.php?pid=190)

According to Table 5, the procedure of calculating Years of potential life lost can be organized as follows:

(1) Calculate the mean age for each age group (column 2) and subtract from the selected age, 75 (column 3)
(2) Calculate the Years of potential life lost for each age group by multiplying the number of deaths (column 1) by the remaining years of life lost (column 3)
(3) Calculate YPLL rate by dividing the sum of the potential years of life lost by age group (93,409) by the total population for the ages selected (12,975,615).

Rate per 1,000 persons
= Total YPLL divided by Population under age 75; = 93,409/12,975,615; = 7.2 per 1,000

Chapter 6

An overview of general mortality trends

In this mortality analysis, the absolute number of deaths, the crude death rates, the standardised mortality rates, age-specific death rates and the life expectancy at exact age are discussed in order to investigate the general mortality levels among the selected countries. The analyses are separated for males and females in 1986, 1997, and 2008 respectively. These years were selected to show some changes throughout the studied period. The period begins with the year of political and economical reforms in the former USSR (1986), then covers the pre-collapse time (1997) and shows mortality levels in an independent period (2008).

Table 6 shows us that number of deaths among males slowly decreases in all the European countries over given period, contrary to that number of deaths increases in 1997 in Kazakhstan, then we observe a decrease in 2008. Index 1997/1986 in Kazakhstan is 143 % and Index 2008/1986 is 137 %, while in other selected countries they are less than 100 %. It reveals that during two past decades there was no reduction in number of death among males in Kazakhstan.

Table 6: Number of deaths in the selected countries, males, selected years

Country	Males					
	Number			Index (%)		
	1986	1997	2008	1997/1986	2008/1997	2008/1986
Kazakhstan	62,001	88,813	85,174	143	96	137
Czech Republic	66,757	56,692	53,076	85	94	80
France	283,779	272,809	271,671	96	100	96
Sweden	49,535	46,720	44,116	94	94	89

Source: Author's calculations based on data from WHO MDB

Table 7: Number of deaths in the selected countries, females, selected years

Country	Females					
	Number			Index (%)		
	1986	1997	2008	1997/1986	2008/1997	2008/1986
Kazakhstan	57,148	71,325	67,532	125	95	118
Czech Republic	65,831	56,052	51,872	85	93	79
France	263,147	257,510	260,803	98	101	99
Sweden	43,733	46,629	47,426	107	102	108

Source: Author's calculations based on data from WHO MDB

The situation among females is quite opposite. Index in Kazakhstan increases in 1997/1986 (125 %), and stabilizes in 2008/1997 (95 %). We can see that value in number of deaths decreases only in the Czech Republic among the selected countries between the years 1986-2008, where Index does not prevail more than 93 % in 2008/1997. France shows fluctuation going down in 1997 and then rising again in 2008, however Index shows stable value throughout the period under observation (Table 7). Number of deaths among Swedish females constantly grows, but without great differences.

Although number of deaths provides basic information about mortality in given country or region, it does not reflect the size and structure of population. Considering that several other indicators are constructed in demography, the crude death rate is presented for the selected countries in Table 8 and Table 9. At the beginning of the period, in 1986 the highest crude death rate belongs to the Czech Republic, where for males it equals to 1,329.1 and for females is 1,237.1. The lowest crude death rate is observed in Kazakhstan, it comprises both sexes, for males - 804.3 and for females - 692.1. France and Sweden show similar values of CDR in both sexes, but France reveals better results in 1986. And in 1997 we observe reduction in values of crude death rates in France and the lowest CDR in both sexes. The highest rate was found out among Kazakhstan males - 1,193.0 in 1997 (Table 8), among females the highest rate belongs to the Czech Republic - 1,059.0 in 1997 (Table 9). The rates of 2008 show us clearly that the highest value belongs to males in Kazakhstan - 1,129.5, among females it is Sweden – 1,023.0.

But, we can not rely on the crude death rates when comparing different populations. Because, if countries have different age-distributions in populations, a comparison of their crude death rates can produce a misleading impression. Therefore, using age-standardized mortality rates will remove the effect of these differences, and help to show which of the populations has the higher mortality.

Table 8: Crude death rates (per 100,000 population) in the selected countries, males, selected years

Country	**Males**					
	CDR			**Index (%)**		
	1986	**1997**	**2008**	**1997/1986**	**2008/1997**	**2008/1986**
Kazakhstan	804.3	1,193.0	1,129.5	148	95	140
Czech Republic	1,329.1	1,131.5	1,038.0	85	92	78
France	1,050.9	955.9	900.5	91	94	86
Sweden	1,198.7	1,068.9	962.4	89	90	80

Source: Author's calculations based on data from WHO MDB

Table 9: Crude death rates (per 100,000 population) in the selected countries, females, selected years

Country	**Females**					
	CDR			**Index (%)**		
	1986	**1997**	**2008**	**1997/1986**	**2008/1997**	**2008/1986**
Kazakhstan	692.1	881.0	830.4	127	94	120
Czech Republic	1,237.1	1,059.0	975.7	86	92	79
France	926.8	856.3	811.6	92	95	88
Sweden	1,032.0	1,041.9	1,023.0	101	98	99

Source: Author's calculations based on data from WHO MDB

The crude death rate is calculated from the total number of deaths and size of the mid-year population. However, we should not forget that changes in the age-distribution of the population can affect trends shown by the crude death rate. That's why one can use age-standardized mortality rate, which helps to show more clearly any trend in mortality, and to find out the extent to which death rates are really changing over time. The age-standardized mortality rates in 1986 show us that Kazakhstan and the Czech Republic have almost the same levels of mortality among both sexes, but Kazakhstan reveals better age-standardized mortality rates, than France follows, and Sweden with the lowest age-standardized mortality rate settles on the "top" among the selected countries (Tables 10 and 11). In 1997, we observe different picture, the highest ASMR among males is found in Kazakhstan – 2,093.6, and the value is striking, because in comparison with the values observed in the selected countries, it almost doubled. The favourable rate belongs to Sweden, where it was 794.6 (Table 10). The situation among females in Kazakhstan is the same as among males, the ASMR is 1,094.6, and it is the highest value among other countries (Table 11). Time trends present the following picture, in 2008 Kazakhstan shows the highest age-standardized mortality rates in both sexes: for males – 1,829.6, and for females – 1,002.1. While ASMR in the same period in other selected countries do not prevail even 1,000.0 among males, and not more than 600.0 among females.

We can conclude that nowadays Kazakhstan faces the highest ASMR in both sexes in comparison with the selected European countries, and it does not make benefit to the health status of the country.

Table 10: Age-standardized mortality rates (per 100,000 population) in the selected countries, males, selected years

Country	Males					
	ASMR			Index (%)		
	1986	1997	2008	1997/1986	2008/1997	2008/1986
Kazakhstan	1,550.5	2,093.6	1,829.6	135	87	118
Czech Republic	1,590.6	1,251.6	966.5	79	77	61
France	1,102.3	838.2	689.8	76	82	63
Sweden	973.0	794.6	642.9	82	81	66

Source: Author's calculations based on data from WHO MDB

Table 11: Age-standardized mortality rates (per 100,000 population) in the selected countries, females, selected years

Country	Females					
	ASMR			Index (%)		
	1986	1997	2008	1997/1986	2008/1997	2008/1986
Kazakhstan	887.8	1,094.6	1,002.1	123	92	113
Czech Republic	953.9	744.4	576.7	78	77	60
France	579.2	442.9	381.5	76	86	66
Sweden	579.5	497.2	443.5	86	89	77

Source: Author's calculations based on data from WHO MDB

Comparing the selected countries, we can notice that infant mortality rates (IMR) in Kazakhstan for both sexes reach the highest values (per 1,000 live births): 31.7 for males, and 25.6 for females in 1986. While IMR for the Czech Republic does not prevail 14.0 for males, and 10.5 for females in the same year. France and Sweden show the lowest IMR: 9.0 - 6.6 for males, and 7.0 - 5.2 for females respectively. The situation in 1997, and even in 2008 in case of Kazakhstan changed, but not so significantly (see Tables 12-13). Time trends show clearly that IMR positively decreases in all these countries, but Kazakhstan show the highest values throughout the period under observation. Index 2008/1986 proves that fact, percentage for the selected European countries do not reach 50 percent for both sexes, when Kazakhstan comprises 75 percent. In past times, infant mortality claimed a considerable percentage of children born, but due to high technology, medical advances, improvements in basic health care IMR have significantly declined especially in the European countries in modern times. At present Kazakhstan still lags behind the countries under comparison in the reduction of IMR which is often used as indicator of the level of health in a country.

Table 12: Infant mortality rates (per 1,000 live births) in the selected countries, males, selected years

Country	Males					
	IMR			Index (%)		
	1986	1997	2008	1997/1986	2008/1997	2008/1986
Kazakhstan	31.7	29.2	23.7	92	81	75
Czech Republic	14.0	6.3	3.3	45	52	23
France	9.0	5.3	3.6	59	68	40
Sweden	6.6	4.1	2.5	62	61	38

Source: Author's calculations based on data from WHO MDB

Table 13: Infant mortality rates (per 1,000 live births) in the selected countries, females, selected years

Country	Females					
	IMR			Index (%)		
	1986	1997	2008	1997/1986	2008/1997	2008/1986
Kazakhstan	25.6	21.3	19.1	83	90	75
Czech Republic	10.5	5.4	2.4	52	44	23
France	7.0	4.1	3.1	59	76	45
Sweden	5.2	3.1	2.5	61	79	48

Source: Author's calculations based on data from WHO MDB

The most commonly used measure of overall mortality intensity differences across countries is life expectancy at birth. Significantly, the life expectancy at birth represents the average life span of a newborn. National health care systems are supposed to contribute to the health of their inhabitants. The importance of this topic was emphasized in the WHO initiative Health for all by the year 2000 (WHO 1981), which targets reductions in health differences within and between countries. Nowadays we have an opportunity to evaluate how objectives identified by the WHO have been fulfilled. In this sense, life expectancy at birth is one of the most widely used indicators for these purposes.

Kazakhstan's expectation of life at birth decreased between 1986 (64.2 years) and 2008 (61.9 years) by 2.3 years for males, in 1997 it was 59.3 years. The value for females decreased between 1986 (73.0 years) and 2008 (72.4 years) by 0.6 years too, in 1997 it was 70.5 years. It were the lowest values of life expectancy at birth among the selected countries. Between 1987 and 1995, mortality rates more than doubled for men aged 30-44 and rose to about 75 % for men aged 45-54 (Kulzhanov and Rechel 2007). In addition, Kazakhstan's males experienced negative changes in life expectancy at birth. With the collapse of inter-republic trade and the simultaneous transition to a market economy, the era of economic collapse was mirrored by a deteriorating life expectancy at birth. Consequently, the economic recovery has not been accompanied by a comparably symmetric rise in life expectancy at birth.

According to Table 14 in 1986 the life expectancy at birth in the Czech Republic for males was 67.5 years and 74.7 for females. In 1997 it was equal to 70.5 for males, and 77.5 for females. Nowadays, the situation in the Czech Republic has positively changed as the country has resumed its health progress. The life expectancy at birth in the Czech Republic increased to 74.1 years for males and 80.5 years for females in 2008. Between 2008-1986 years differences of values equal to 6.6 years for males and 5.8 years for females. The relatively high standard of health care, sanitary culture and economic development on the territory of France and Sweden determined a higher level of life expectancy at birth in comparison with the other selected countries. In 1986 life expectancy at birth was 71.7 for males in France. French females show 79.9 years. Sweden reveals the favourable level of life expectancy at birth in 1986 for males (74.0) and females (80.1). In 1997 we can observe only positive increase in values of life expectancy at birth among both sexes in France and Sweden. In the case of France and Sweden the life expectancy at birth for males increased by 6.1 and 5.2 years comparing the years 1986 and 2008. Concerning females in these countries the life expectancy at birth increased by 4.9 years in France and 3.0 years in Sweden respectively (see Table 14).

Table 14: Life expectancy in the selected countries, males and females, selected years

Kazakhstan							
Indicator	**Sex**	**1986**	**1997**	**2008**	**1997-1986**	**2008-1997**	**2008-1986**
Life expectancy at birth	Males	64.2	59.3	61.9	-4.9	2.6	-2.3
	Females	73.0	70.5	72.4	-2.5	1.9	-0.6
	Gender gap	8.9	11.2	10.6	2.3	-0.6	1.7
Life expectancy at age 65	Males	12.6	10.8	11.5	-1.8	0.8	-1.1
	Females	16.6	14.8	15.3	-1.7	0.5	-1.2
	Gender gap	3.9	4.0	3.8	0.1	-0.2	-0.2
Czech Republic							
Indicator	**Sex**	**1986**	**1997**	**2008**	**1997-1986**	**2008-1997**	**2008-1986**
Life expectancy at birth	Males	67.5	70.5	74.1	3.0	3.6	6.6
	Females	74.7	77.5	80.5	2.8	2.9	5.8
	Gender gap	7.2	7.0	6.4	-0.2	-0.6	-0.8
Life expectancy at age 65	Males	11.5	13.2	15.3	1.7	2.1	3.8
	Females	14.8	16.7	18.8	1.9	2.1	4.0
	Gender gap	3.3	3.5	3.5	0.2	0.0	0.2
France							
Indicator	**Sex**	**1986**	**1997**	**2008**	**1997-1986**	**2008-1997**	**2008-1986**
Life expectancy at birth	Males	71.7	75.2	77.9	3.5	2.7	6.1
	Females	79.9	83.0	84.8	3.1	1.8	4.9
	Gender gap	8.2	7.8	7.0	-0.4	-0.9	-1.3
Life expectancy at age 65	Males	14.6	16.8	18.5	2.2	1.7	3.9
	Females	19.1	21.5	23.0	2.4	1.5	3.8
	Gender gap	4.5	4.5	4.4	0.0	0.0	0.0
Sweden							
Indicator	**Sex**	**1986**	**1997**	**2008**	**1997-1986**	**2008-1997**	**2008-1986**
Life expectancy at birth	Males	74.0	76.7	79.1	2.7	2.4	5.2
	Females	80.1	81.9	83.2	1.8	1.3	3.0
	Gender gap	6.2	5.2	4.1	-0.9	-1.2	-2.1
Life expectancy at age 65	Males	14.8	16.3	18.0	1.4	1.7	3.2
	Females	18.9	20.0	20.9	1.2	0.9	2.0
	Gender gap	4.0	3.8	2.9	-0.3	-0.9	-1.1

Source: Author's calculations based on data from WHO MDB

To understand the low life expectancy at birth in Kazakhstan among the selected countries, the impact of the economic crisis that occurred after the collapse of the USSR must be explored. Equally, issues such as increasing poverty and deteriorating health also deserve to be mentioned. The mortality condition in Kazakhstan in the taken time period is worrisome. The increase in mortality level over the past decade gives particular cause for concern, because this increase represents a setback to health efforts of the past twenty two years and because it presages serious long term health consequences in the general population. Low economic development and lowered standards of living that followed independence caused the results of these consequences. There may also be an increase in deaths from alcohol. In contrast, the life expectancy at birth rose sharply in the late 1980's because of the anti-alcohol campaign. Also should be taking into account the differences in the definition of infant mortality rate. It includes two different practices of registration of live births and stillbirths. The first is namely "Soviet" and the second is the "WHO" registration practices of live births and stillbirths. There are some differences in these definitions, which were explained in the sub-chapter of data and quality.

Excess male mortality between male and female life expectancy at birth among the selected countries in the period from 1986 to 2008 clearly illustrates in Table 14. In the beginning of selected time period the lowest excess male mortality belongs to Sweden and it equals to 6.2 years. The highest level of this indicator was observed in Kazakhstan as 8.9 years. Excess male mortality in the Czech Republic was equal to 7.2 years in 1986, while in France at the same period it was 8.2 years. The selected European countries, except Kazakhstan reveal decline in excess male mortality in 1997. In 2008, we can see the following situation, where excess male mortality in Sweden is equal to 4.1, we observe decline in taken time period. In the case of the Czech Republic excess male mortality decreased from 7.2 years in 1986 to 6.4 years in 2008, and from 8.2 to 7.0 years in the same time period in France. While the rate of excess male mortality in Kazakhstan is 10.6 years in 2008, and it slightly decreased in comparison with 1997, where it was equal to 11.2 years.

The observed differences in the values of excess male mortality among the selected countries may be caused by several factors. While some scholars argue that women are biologically better to men and thus live longer, others argue that men are employed in more hazardous occupations such as in factories, military service and so on (Oksuzyan, Brønnum-Hansen, and Jeune 2010). Moreover, there are very likely to be genetic factors that relate to the difference in longevity. The genetic differences are expressed in the hormonal, immunological, and other physiologic differences in men and women.

While the life expectancy at birth makes Kazakhstan look much worse in the values in comparison with the other selected countries, the situation concerning the values for life expectancy at the age 65 years are a little bit different (see Table 14). The life expectancy at age 65 is considered for number of reasons. For example, adult mortality is affected by factors that are different from those affecting infant mortality, and thus it is to have a distinct dynamics. Studies have stressed the importance of adult mortality in explaining fluctuations in life expectancy in Kazakhstan. The reported adult life expectancy presents some curious patterns that require further scrutiny.

Table 15: Age composition of populations of Kazakhstan and the selected European countries, males and females, selected years of the period 1986-2008, (in percent)

Year	Age group	Kazakhstan		Czech Republic		France		Sweden	
		Males	Females	Males	Females	Males	Females	Males	Females
1986	0-14	33.6	30.5	24.4	21.9	22.0	19.9	18.7	17.3
	15-64	62.9	61.9	66.3	63.5	67.5	64.3	66.1	62.9
	65+	3.5	7.5	9.3	14.5	10.5	15.8	15.2	19.8
	AI	10.4	24.7	38.2	66.1	47.6	79.4	81.3	113.9
	EBI	58.9	61.5	50.8	57.4	48.1	55.6	51.3	59.0
1997	0-14	31.0	28.2	18.6	16.7	19.4	17.6	19.5	18.0
	15-64	64.4	62.8	70.8	66.9	67.3	63.9	65.6	62.1
	65+	4.6	9.0	10.6	16.3	13.3	18.5	14.9	19.9
	AI	14.9	31.8	57.2	97.4	68.8	105.6	76.6	110.4
	EBI	55.2	59.2	41.3	49.4	48.6	56.5	52.4	61.1
2008	0-14	25.6	22.6	14.9	13.5	19.4	17.3	17.3	16.2
	15-64	68.9	67.9	73.2	69.0	66.5	63.7	67.1	64.2
	65+	5.5	9.5	11.9	17.4	14.1	19.0	15.6	19.6
	AI	21.6	42.1	80.3	128.6	72.9	109.6	90.7	121.1
	EBI	45.2	47.4	36.6	44.8	50.3	57.0	49.0	55.8

Notes: AI - aging index $\frac{P_{65+}}{P_{0-14}} * 100$, EBI - index of economic burden $(\frac{P_{65+} + P_{0-14}}{P_{15-64}}) * 100$

Source: Author's calculations based on data from WHO MDB

According to Table 14 in 1986 the life expectancy at age 65 in Kazakhstan for males was 12.6 years and 16.6 for females. Expectation of life at age 65 in the Czech Republic was 11.5 for males, and 14.8 for females. We can see that the population of Kazakhstan in the age group of 65 years and more has a much younger biological age, which makes its life expectancy higher than in the Czech Republic in the 1980th (see Table 15). After 1991, Kazakhstan and the Czech Republic had the equal level of the life expectancy at age 65 for both sexes. Within the next decade, the life expectancy at age 65 decreased in Kazakhstan in 1997 for males it was equal to 10.8 years, and for females - 14.8. The differences in the life expectancy at age 65 remained at the same level until 2008, where Kazakhstan stands out with the lowest life expectancy at age 65 - 11.5 years for males, and 15.3 years for females. After the collapse of the communist system, the Czech Republic reached the level achieved by developed countries by a rapid economic progress, while Kazakhstan underwent a crisis of collapse in every sphere. Kazakhstan did not exceed the level of 1986, and even decreased in comparison with 2008. The selected European countries experienced a steady growth reflecting improvements in living conditions, especially in terms of wealth, housing, nutrition and health care. Although increased life expectancy is advantageous to society it also challenges the sustainability of public finances, the health care system and the provision of care for the elderly. In the case of France and Sweden the life expectancy at age 65 for males increased by 3.9 and 3.2 years comparing the years 1986 and 2008. Concerning females in these countries the life expectancy at age 65 increased by 3.8 years in France and 2.0 years in Sweden respectively. The life expectancy at age 65 in France and Sweden are almost on the same level for both sexes and have the highest values among the observed countries throughout the whole period (see Table 14).

In Figures 1 and 2, we analyze the age-specific death rates in the selected countries in the years 1986, 1997 and the last available year - 2008. In 1986 among males ASDR for all the selected countries at age 0 show some tendencies and Kazakhstan has the highest rate at that age group, while other age groups especially from (1-4) to (10-14) show significant level of age-specific death rates in comparison with the selected countries (Figure 1). In 1986 among males the highest rates of ASDR belong to Kazakhstan especially in age groups from (0) to (50-54). The lowest was observed in Sweden. Kazakhstan in age groups from (55-59) till (65-69) has the same rates as the Czech Republic, and then in older age groups (80-84) and (85+) it is closer to France and Sweden. The Czech Republic shows high age-specific death rates in age groups from (70-74) to (85+) in 1986. In 1997 we observe the following picture among males, where Kazakhstan shows the highest ASDR in all age groups. The selected European countries have common features in age groups (0), (1-4) and (5-9). In age groups from (10-14) to (35-39) the Czech Republic and France show similar trends. Although France has the similar values with Sweden in age groups from (65-69) to (85+). Sweden at the same time period reveals the lowest ASDR among males starting from (10-14) to (60-64) age groups. In 2008, Kazakhstan still shows the highest ASDR in all age groups. The selected European countries have similar trends in age-specific death rates from age group (0) to (20-24) at the same time period. Then we can see that the Czech Republic together with France have identical trends from (20-24) to (40-44), while Sweden shows the lowest ASDR among the selected countries from age groups (25-29) till (60-64). Starting from (65-69) age group France and Sweden reveal both similar trends till age group (85+) (Figure 1).

Figure 1: Age-specific death rates (per 100,000 population) in the selected countries, males, selected years

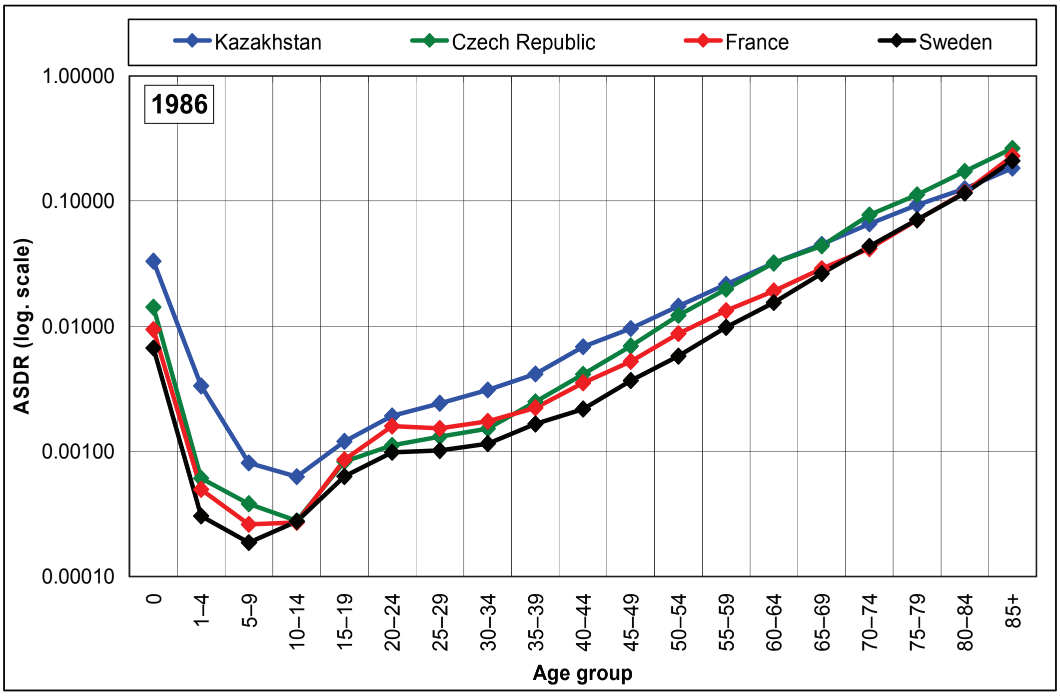
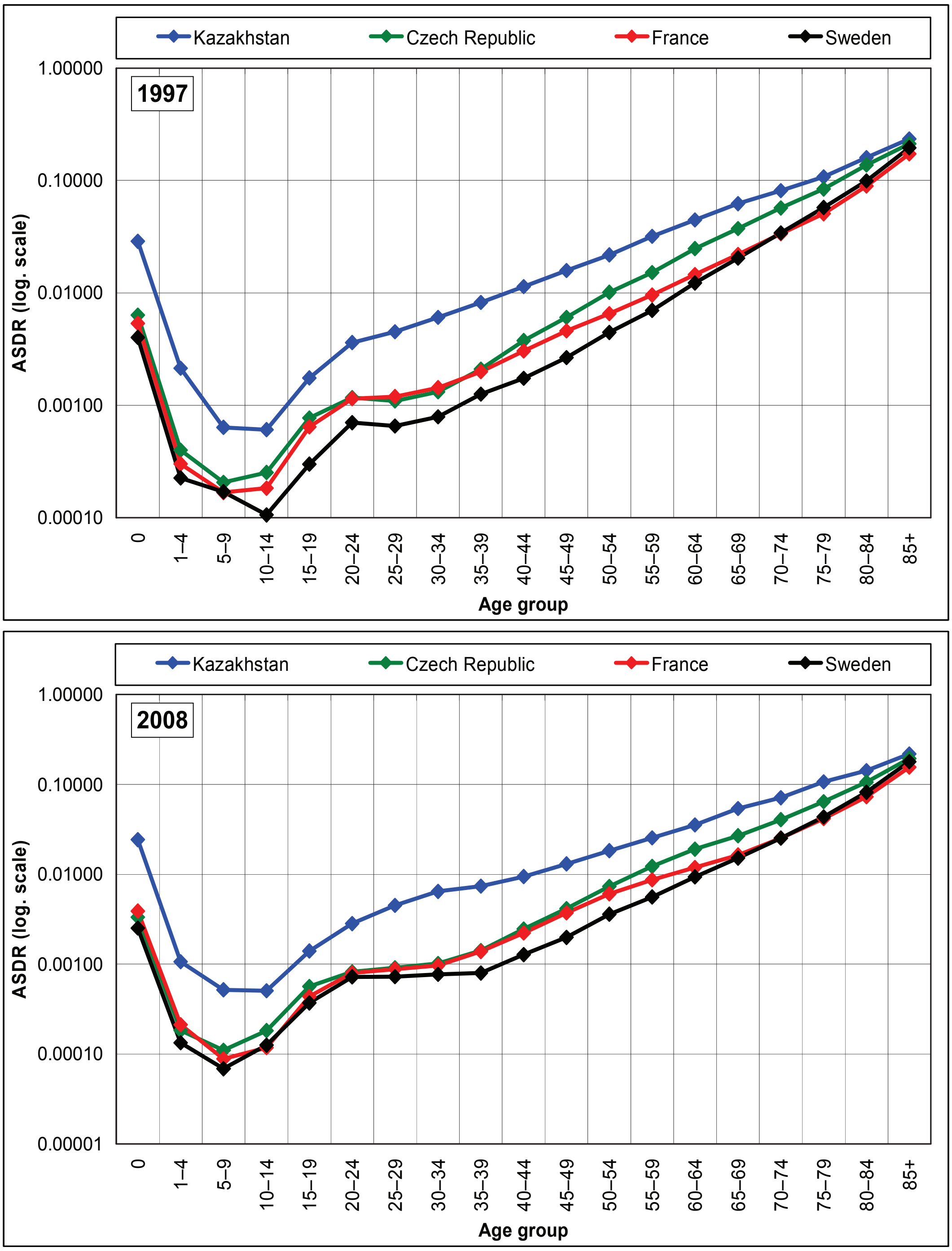


Figure 1: Continued



Source: Author’s calculations based on data from WHO MDB

According to Figure 2 we can say that in 1986 among females the highest age-specific death rate was observed in Kazakhstan in age groups from (0) till (55-59). In age groups (60-64) and (65-69) Kazakhstan and the Czech Republic show identical values. Then from (70-74) till (85+) the highest ASDR belongs to the Czech Republic. France and Sweden both mostly reveal similar trends throughout all age groups. In 1997, we can observe the following picture, Kazakhstan shows the highest ASDR in all age groups, except (80-84) and (85+), where Kazakhstan and the Czech Republic obtain the same values. The Czech Republic show trends which are closer to France in age groups (0) till (40-44). Sweden reveals the lowest ASDR in age groups (0) till (45-49). France and Sweden has the same age-specific death rates in age groups (50-54) and (50-59). After that France shows the lowest ASDR in age groups (60-64) till (85+). The highest age-specific death rates were found in Kazakhstan in 2008. Especially, big differences in comparison with the selected countries were observed in age groups (0) till (50-54). In 2008 females in the selected European countries show the same trends like males, for example from age groups (0) till (25-29) they have similar trends. Then we observe that Sweden reveals better values in age groups (30-34) till (50-54). In age group (50-59) France and Sweden show identical values. From age groups (60-64) till (85+) the favorable trend in age-specific death rates was observed among French females (Figure 2).

Figure 2: Age-specific death rates (per 100,000 population) in the selected countries, females, selected years

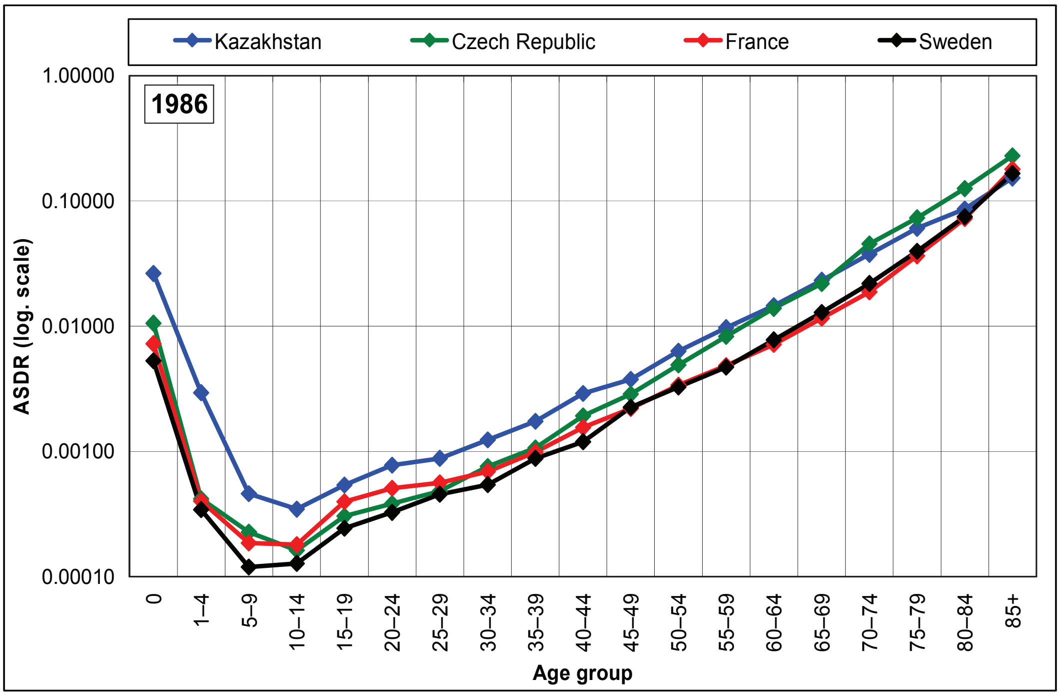
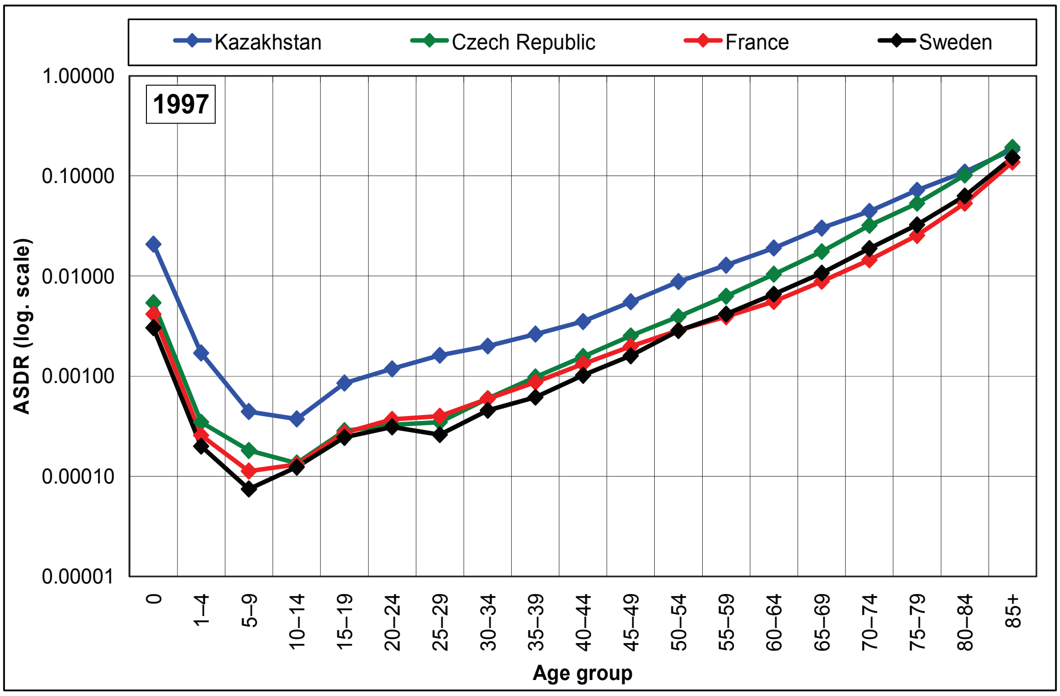
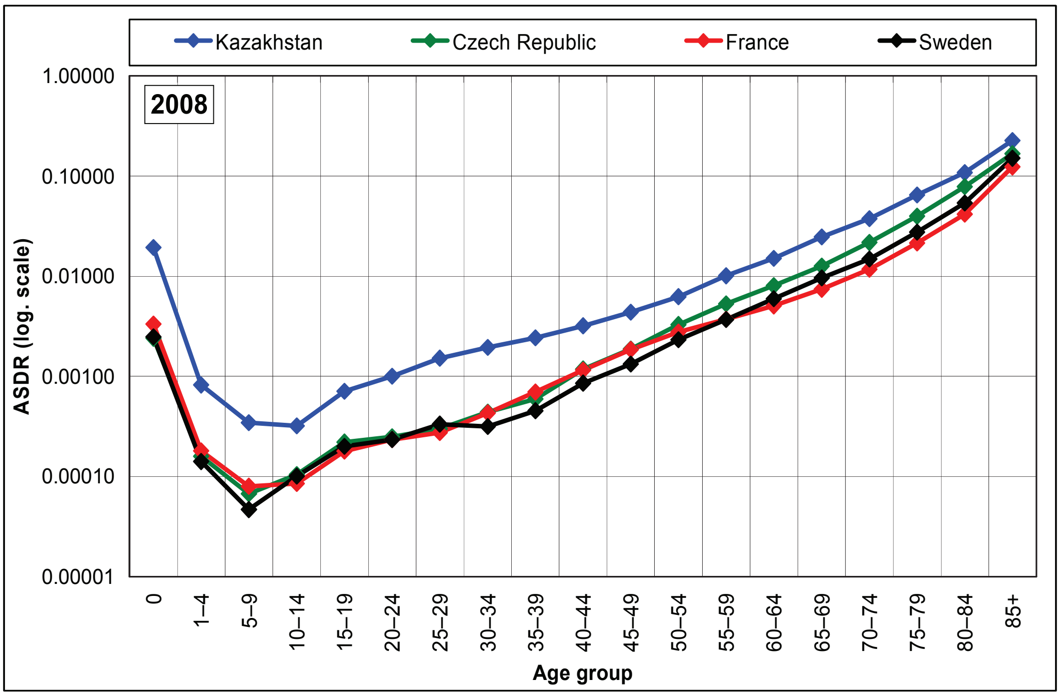


Figure 2: Continued





Source: Author's calculations based on data from WHO MDB

In this chapter the differences in overall mortality intensity over time among the selected countries from 1986 to 2008 were analyzed. The lowest life expectancy at birth was found in Kazakhstan, while the highest value belonged to Sweden through the whole time period. A large gender gap in life expectancy at birth was observed in Kazakhstan and the shortest one in Sweden. The lowest life expectancy at age 65 in 1986 was observed in the Czech Republic in both sexes and the highest value belonged to Sweden. At the end of analysis the lowest life expectancy at age 65 was found out in Kazakhstan in both sexes, and the highest value was obtained by France. We can see that males and females have common character in results of age-specific death rates. Starting from age group (40-44) and going on till the last age group (85+) one can find that age-specific death rates only increase. In the periods 1997 and 2008 Kazakhstan hits „all records“, taking the highest ASDR in all age groups, showing the worst mortality development among the selected countries. Concerning females the situation is identical. Between the given years age-specific death rates among females in Kazakhstan like among males in the same time period have increased significantly and have rates two times more in comparison with France and Sweden females (see Figures 1 and 2).

Chapter 7

Mortality trends by main causes of death

The development of mortality by age and sex differences between the selected countries was put forward in the previous chapter. An in-depth analysis of causes of death will give further insights into the reasons of the differentials. Charts showing the intensity of mortality from major groups of causes of death are available for both sexes separately in the text and also in Annex, where one can find corresponding Figures giving the overview of intensity of mortality from main causes of death in the selected countries, which also compare data between males and females (see Figures A1-A2).

Here, we analyze mortality intensity from main groups of causes of death, in the selected countries for males. Time trends of overall mortality among males show us that ASMR in the selected European countries decrease in each decade, while in Kazakhstan it grows up in 1997, and at the end of analysis we observe decline. Nevertheless, values in Kazakhstan in comparison with the selected countries are different significantly, especially in 2008 (ASMR 1,829.6 per 100,000 inhabitants) (see Table 16; Annex, Figure A1).

The diseases of the circulatory system among males is the leading cause of death among the selected countries. According to Table 16, we can say that Kazakhstan reveals high rates from circulatory diseases during the period of 1986-2008. The trends of circulatory diseases gradually decline among all the European countries throughout the whole period, only in case of Kazakhstan we see increase of mortality intensity in 1997 (ASMR 1,033.4 per 100,000 inhabitants), and decline in 2008 (ASMR 973.8 per 100,000 inhabitants). However, the value of 2008 in Kazakhstan is much higher than it was in 1986 (ASMR 727.5 per 100,000 inhabitants).

The second leading cause of death in the selected countries includes deaths associated with neoplasms. Throughout the selected years (1986, 1997 and 2008) we can see decline in mortality from neoplasms in Kazakhstan and in the selected European countries as well. In case of Kazakhstan this reduction in cancer mortality did not result from any improvement of medical care, but mainly because of a low survival of population until old age groups, because it is known well that the risk to fall ill with cancer among men and women appears in the older ages.

Table 16: Age-standardized mortality rates from main groups of causes of death (per 100,000 population) in the selected countries, males, selected years

Country	MALES					
	ASMR			Index (%)		
	1986	1997	2008	1997/1986	2008/1997	2008/1986
	Overall mortality					
Kazakhstan	1,550.5	2,093.7	1,829.6	135	87	118
Czech Republic	1,590.6	1,251.6	966.5	79	77	61
France	1,102.3	838.3	689.8	76	82	63
Sweden	972.9	794.7	643.0	82	81	66
	Circulatory diseases					
Kazakhstan	727.5	1,033.4	973.8	142	94	134
Czech Republic	848.5	660.9	437.1	78	66	52
France	348.6	231.1	163.1	66	71	47
Sweden	510.8	363.8	245.3	71	67	48
	Neoplasms					
Kazakhstan	310.7	285.7	225.5	92	79	73
Czech Republic	353.4	332.2	272.8	94	82	77
France	322.1	279.4	240.2	87	86	75
Sweden	201.5	200.4	175.1	99	87	87
	Respiratory diseases					
Kazakhstan	185.5	192.3	112.9	104	59	61
Czech Republic	103.5	51.6	58.0	50	112	56
France	79.1	64.0	38.6	81	60	49
Sweden	76.4	54.4	38.9	71	72	51
	External diseases					
Kazakhstan	98.0	259.2	217.6	264	84	222
Czech Republic	109.7	102.4	76.9	93	75	70
France	112.7	85.8	64.5	76	75	57
Sweden	75.3	56.2	54.4	75	97	72
	Digestive diseases					
Kazakhstan	57.6	76.5	85.4	133	112	148
Czech Republic	63.4	46.4	47.3	73	102	75
France	66.3	44.0	30.8	66	70	46
Sweden	26.8	21.8	21.5	81	99	80
	Infectious diseases					
Kazakhstan	44.4	95.5	36.9	215	39	83
Czech Republic	5.8	2.8	8.2	48	294	141
France	13.3	10.6	13.3	79	126	100
Sweden	6.0	7.2	11.4	120	159	190
	Other diseases					
Kazakhstan	126.8	151.1	177.5	119	117	140
Czech Republic	106.3	55.3	66.2	52	120	62
France	160.2	123.4	139.3	77	113	87
Sweden	76.1	90.9	96.4	119	106	127

Source: Author's calculations based on data from WHO MDB

Then the diseases of the respiratory system follow. Before the collapse of the Soviet Union, the incidence of respiratory diseases was relatively high in Kazakhstan. This was mostly caused by the drying of the Aral Sea and other ecological problems, we have to note that these problems did not hold for whole Kazakhstan. After the dissolution of USSR, we can see a relative improvement caused by big attention of international organizations to the problem of the Aral Sea and of course by the closure of the Semipalatinsk nuclear test site in East Kazakhstan. Malignant neoplasms, which comprises a significant part in the structure of mortality intensity by cause of death, is also related to above mentioned ecological problems. Time trends show that ASMR from respiratory diseases was equal to 112.9 per 100,000 inhabitants among males of Kazakhstan in 2008, while in the selected European countries these rates were not higher than 60.0 per 100,000 inhabitants (see Table 16).

The decrease in cancer and respiratory diseases was accompanied by a steadily increasing mortality from external causes of death. It is well seen in Kazakhstan where the share of external causes increased from 98.0 per 100,000 inhabitants in 1986 to 259.2 per 100,000 inhabitants in 1997, and in 2008 decreased to 217.6 per 100,000 inhabitants. The selected European countries show continuous decline in trends of external causes of death.

The deterioration of life conditions, mainly in diet, can be blamed for an increase in the share of the diseases of the digestive system. Kazakhstan reveals only gradual increase in mortality intensity from digestive diseases. In 1986 ASMR was 57.6 per 100,000 inhabitants, then in 1997 equal to 76.5 per 100,000 inhabitants, and finally in 2008 it was 85.4 per 100,000 inhabitants. Among the selected European countries, only France shows steadily decline in values from digestive diseases. From Table 16, we can observe that mortality intensity from this disease is almost unchangeable between 1997 and 2008 among males in the Czech Republic and Sweden.

Unfortunately, mortality caused by infectious diseases still exist in Kazakhstan. In 1986 ASMR from this cause of death was 44.4 per 100,000 inhabitants. There was a sharp increase in 1997 - 95.5 per 100,000 inhabitants, and significant decline in 2008 – 36.9 per 100,000 inhabitants, which means that mortality intensity declined more than two times. Relatively high ASMR was observed in France. Sweden shows stable trends. In the case of the Czech Republic in the year 1997 we find out the lowest rate 2.8 per 100,000 inhabitants from infectious diseases among all the selected countries throughout the whole period.

Group of other diseases is very significant among other main groups of causes of death. Time trends are very heterogeneous among the selected countries. Kazakhstan and Sweden show gradually increase in mortality intensity from other diseases throughout the whole period. The Czech Republic and France have common features in ASMR during the given period. For example, in 1997 they both reveal decline in mortality intensity from this cause of death, and in 2008 there was observed an increase in age-standardized mortality rates from this group of diseases.

Now we analyze mortality intensity from main groups of causes of death, in the selected countries for females. According to Table 17 the situation concerning overall mortality among females is similar like among males. Kazakhstan shows an increase in 1997 and then we observe insignificant decline in 2008. Females of the other countries reveal gradual decline during the whole period (see also Annex, Figure A2).

Mortality intensity from circulatory diseases has the following description, Kazakhstan shows increase in 1997, and like in case of overall mortality we see decline in 2008. The selected European countries reveal better trends from circulatory diseases, we observe positive decline in values from this disease. We can single out France, where ASMR in 2008 was 95.1 per 100,000 inhabitants, and it was the lowest level of mortality intensity among the selected countries. The situation among females of Kazakhstan looks unfavourable in comparison with other countries, where ASMR was 594.9 per 100,000 inhabitants in the same year.

Table 17: Age-standardized mortality rates from main groups of causes of death (per 100,000 population) in the selected countries, females, selected years

Country	FEMALES					
	ASMR			Index (%)		
	1986	1997	2008	1997/1986	2008/1997	2008/1986
	Overall mortality					
Kazakhstan	887.7	1,094.5	1,002.1	123	92	113
Czech Republic	954.0	744.5	576.6	78	77	60
France	579.2	443.1	381.4	76	86	66
Sweden	579.4	497.2	443.6	86	89	77
	Circulatory diseases					
Kazakhstan	496.1	638.4	594.9	129	93	120
Czech Republic	549.2	428.3	292.3	78	68	53
France	205.4	133.2	95.1	65	71	46
Sweden	287.7	209.9	154.4	73	74	54
	Neoplasms					
Kazakhstan	154.4	146.8	122.0	95	83	79
Czech Republic	190.9	180.9	155.2	95	86	81
France	140.7	127.6	122.6	91	96	87
Sweden	147.3	144.2	135.3	98	94	92
	Respiratory diseases					
Kazakhstan	85.5	71.1	36.3	83	51	42
Czech Republic	48.4	26.6	28.6	55	107	59
France	35.0	30.4	18.1	87	59	52
Sweden	41.5	32.9	26.0	79	79	63
	External diseases					
Kazakhstan	33.1	69.0	55.6	208	81	168
Czech Republic	58.9	40.5	25.5	69	63	43
France	50.8	36.3	25.9	71	72	51
Sweden	30.1	22.8	22.5	76	98	75
	Digestive diseases					
Kazakhstan	31.8	37.6	42.7	118	114	134
Czech Republic	30.1	24.0	24.6	80	103	82
France	32.5	23.0	15.3	71	67	47
Sweden	14.8	13.3	14.0	90	105	94
	Infectious diseases					
Kazakhstan	19.8	23.9	12.1	121	51	61
Czech Republic	3.8	1.5	5.4	40	353	143
France	8.0	6.4	7.8	80	122	97
Sweden	5.1	4.7	8.0	93	168	156
	Other diseases					
Kazakhstan	67.0	107.7	138.5	161	129	207
Czech Republic	72.7	42.7	45.0	59	105	62
France	106.8	86.2	96.6	81	112	90
Sweden	52.9	69.4	83.4	131	120	158

Source: Author’s calculations based on data from WHO MDB

Time trends in mortality intensity among females from neoplasms gives the following picture. All the selected countries reveal steadily decline in values from cancer mortality. The differences in values between countries are relatively low during the period under observation. However, the highest level of mortality intensity belongs to the Czech Republic in the whole period (Table 17).

According to the same Table 17, respiratory diseases among females of the selected countries have common features in mortality intensity for Kazakhstan, France and Sweden. We observe steadily decline in values throughout the period. In case of the Czech Republic, we see decline in 1997 (26.6 per 100,000 inhabitants), and a slight increase in 2008 (28.6 per 100,000 inhabitants) in comparison with the previous year.

External causes of death among females of Kazakhstan reveal an increase in mortality intensity in 1997 (69.0 per 100,000 inhabitants), and a decline in 2008 (55.6 per 100,000 inhabitants). The selected European countries show steadily reduction in values from this disease during the whole period, but the level of mortality intensity in Sweden was unchangeable between the years 1997 and 2008 (see Table 17).

As it was mentioned above mainly poor diet, can be blamed for an increase in the share of the diseases of the digestive system. Kazakhstan shows continuous increase in mortality intensity from this disease. Among the selected European countries only France reveals stable decline in trends of mortality intensity. The Czech Republic and Sweden reveal first reduction in the level of mortality from digestive diseases in 1997, but in 2008 there were observed increasing values in age-standardised mortality rates from this cause of death.

Infectious diseases play great role among females of Kazakhstan. In 1986 ASMR was equal to 19.8 per 100,000 inhabitants, in 1997 it rose to 23.9 per 100,000 inhabitants and in 2008 we see some stabilization in mortality rates from this disease 12.1 per 100,000 inhabitants. But in comparison with the selected European countries these values seem significant, for ASMR observed during the whole period in these countries do not prevail more than 8.0 per 100,000 inhabitants. Further, we observe mortality intensity from other diseases, Kazakhstan and Sweden show stable increasing values in the period. There is a similar tendency among females of the Czech Republic and France, these countries reveal reduction in mortality intensity from this group of causes of death, and in 2008 we see increase in age-standardised mortality rates.

According to Table 18, the highest proportion in the structure of mortality intensity by cause of death from diseases of the circulatory system and neoplasms can be noted in all the selected countries among both sexes throughout the whole period under observation. Moreover in case of Kazakhstan high proportion of respiratory system appears for males during the whole period, among females the situation was more positive. The lowest proportion of mortality intensity can be attributed to the diseases of the digestive system and infectious diseases. However, concerning Kazakhstan mortality from diseases of the digestive system has been increasing since 1986, while mortality from infectious declined. Most deaths from diseases of the digestive system were due to mortality from chronic liver disease and cirrhosis. Mortality from infectious diseases was mostly due to tuberculosis. A nearly double increase recorded in 1997 in Kazakhstan among males. It was due to endocrine and metabolic diseases and those related to nutrition, of which more than half were diabetes. However, mortality from this cause of death was not so significant in comparison with other causes. The age distribution of causes of death points out that some causes prevail in young and others in old ages. External causes, for example, prevail among young adults in the selected countries. Alcohol related causes of death have a major impact in the middle adult age. Cancer, respiratory and circulatory diseases prevail in high age groups (Annex, Figures A4-A7).

Table 18: Structure of mortality intensity from main groups of causes of deaths (in %) in the selected countries, males and females, selected years

Country	MALES			FEMALES		
	1986	1997	2008	1986	1997	2008
	Overall mortality					
Kazakhstan	100.0	100.0	100.0	100.0	100.0	100.0
Czech Republic	100.0	100.0	100.0	100.0	100.0	100.0
France	100.0	100.0	100.0	100.0	100.0	100.0
Sweden	100.0	100.0	100.0	100.0	100.0	100.0
	Circulatory diseases					
Kazakhstan	46.9	49.4	53.2	55.9	58.3	59.4
Czech Republic	53.3	52.8	45.2	57.6	57.5	50.7
France	31.6	27.6	23.6	35.5	30.1	24.9
Sweden	52.5	45.8	38.1	49.7	42.2	34.8
	Neoplasms					
Kazakhstan	20.0	13.6	12.3	17.4	13.4	12.2
Czech Republic	22.2	26.5	28.2	20.0	24.3	26.9
France	29.2	33.3	34.8	24.3	28.8	32.1
Sweden	20.7	25.2	27.2	25.4	29.0	30.5
	Respiratory diseases					
Kazakhstan	12.0	9.2	6.2	9.6	6.5	3.6
Czech Republic	6.5	4.1	6.0	5.1	3.6	5.0
France	7.2	7.6	5.6	6.0	6.9	4.7
Sweden	7.9	6.8	6.0	7.2	6.6	5.9
	External diseases					
Kazakhstan	6.3	12.4	11.9	3.7	6.3	5.5
Czech Republic	6.9	8.2	8.0	6.2	5.4	4.4
France	10.2	10.2	9.4	8.8	8.2	6.8
Sweden	7.7	7.1	8.5	5.2	4.6	5.1
	Digestive diseases					
Kazakhstan	3.7	3.7	4.7	3.6	3.4	4.3
Czech Republic	4.0	3.7	4.9	3.2	3.2	4.3
France	6.0	5.2	4.5	5.6	5.2	4.0
Sweden	2.8	2.7	3.3	2.6	2.7	3.2
	Infectious diseases					
Kazakhstan	2.9	4.6	2.0	2.2	2.2	1.2
Czech Republic	0.4	0.2	0.8	0.4	0.2	0.9
France	1.2	1.3	1.9	1.4	1.4	2.0
Sweden	0.6	0.9	1.8	0.9	0.9	1.8
	Other (residual) diseases					
Kazakhstan	8.2	7.2	9.7	7.5	9.8	13.8
Czech Republic	6.7	4.4	6.8	7.6	5.7	7.8
France	14.5	14.7	20.2	18.4	19.5	25.3
Sweden	7.8	11.4	15.0	9.1	14.0	18.8

Source: Author's calculations based on data from WHO MDB

Here, after making general analysis, we are going to describe relatively detailed analysis. The age-standardized mortality rates by main causes of death will be discussed in order to investigate the cause-specific mortality levels among the selected countries. A comparative analysis of the ASMR by main groups of causes of death will be presented for males and females. The selected causes will be the same during the whole analysis.

A comparison of ASMR levels between men and women in the selected countries shows that overall mortality was lower among women in all major groups of causes of death, which corresponds to the male excess mortality throughout the studied period. In the period prior to the beginning of 90s, the selected countries had different levels of ASMR, but general trends were broadly similar in all countries. The diversity between countries, as seen in Figures 3-10, was higher in male than in female standardized mortality. Particularly in the early 1990s, the ASMR increased in Kazakhstan in both sexes, while the ASMR in the selected European countries declined (Figure 3). The increase among men was the greatest in Kazakhstan. Such sex differences were mostly due to risk factors, high alcohol consumption in particular. When the selected European countries consistently improved the general welfare of the people, which can be mirrored in the development of the trend of ASMR for males as well as females, Kazakhstan experienced an economic and mortality crisis and decline in prosperity. The mortality situation began to improve in the late 1990s, but Kazakhstan did not reach the level of 1986 even in 2008. Kazakhstan keeps a much higher ASMR level than the selected European countries in both sexes. The Czech Republic shows declining in mortality by all causes of death, and approaching France and Sweden, which both present similar trends in both sexes, and also the lowest ones among the selected countries.

Figure 3: Age-standardized mortality rates from all causes of death (per 100,000 population) in the selected countries, males and females, 1986-2008

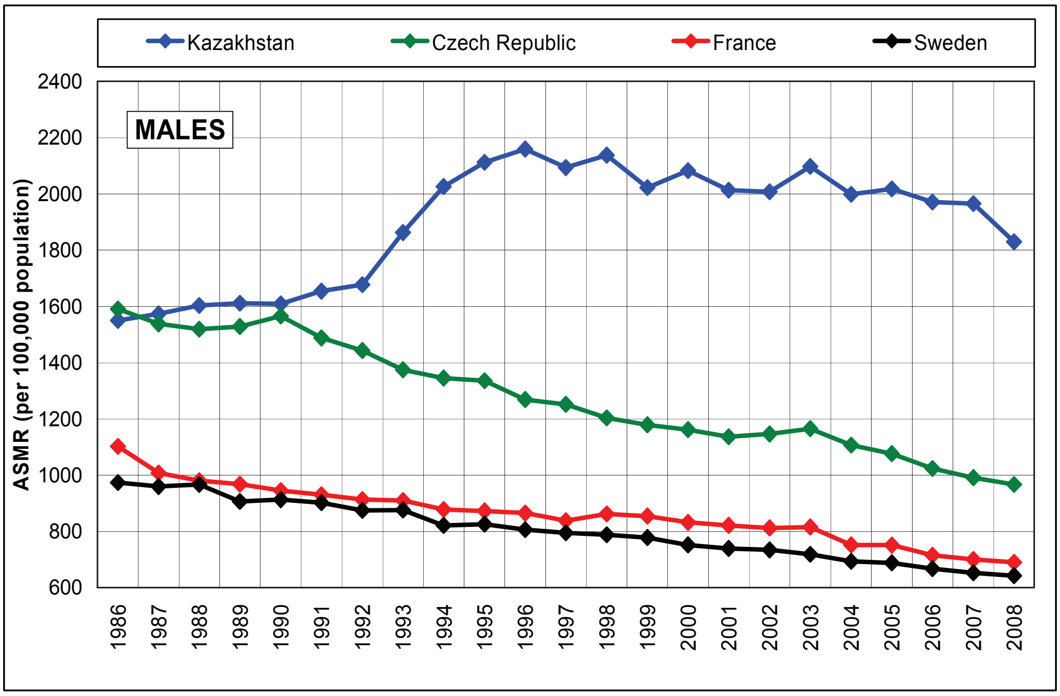
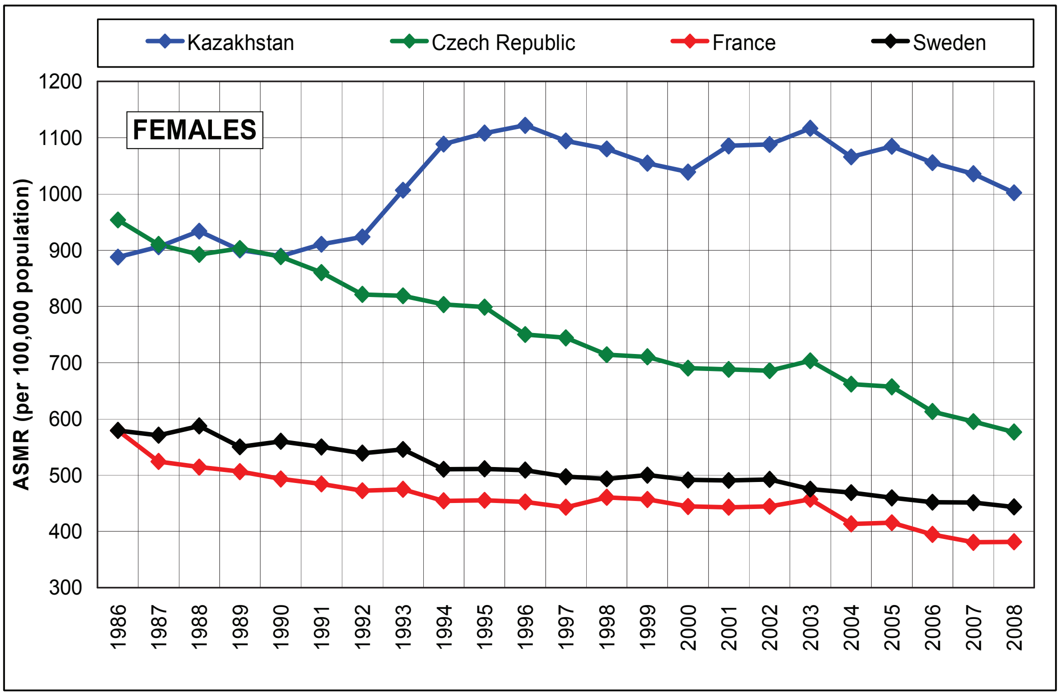


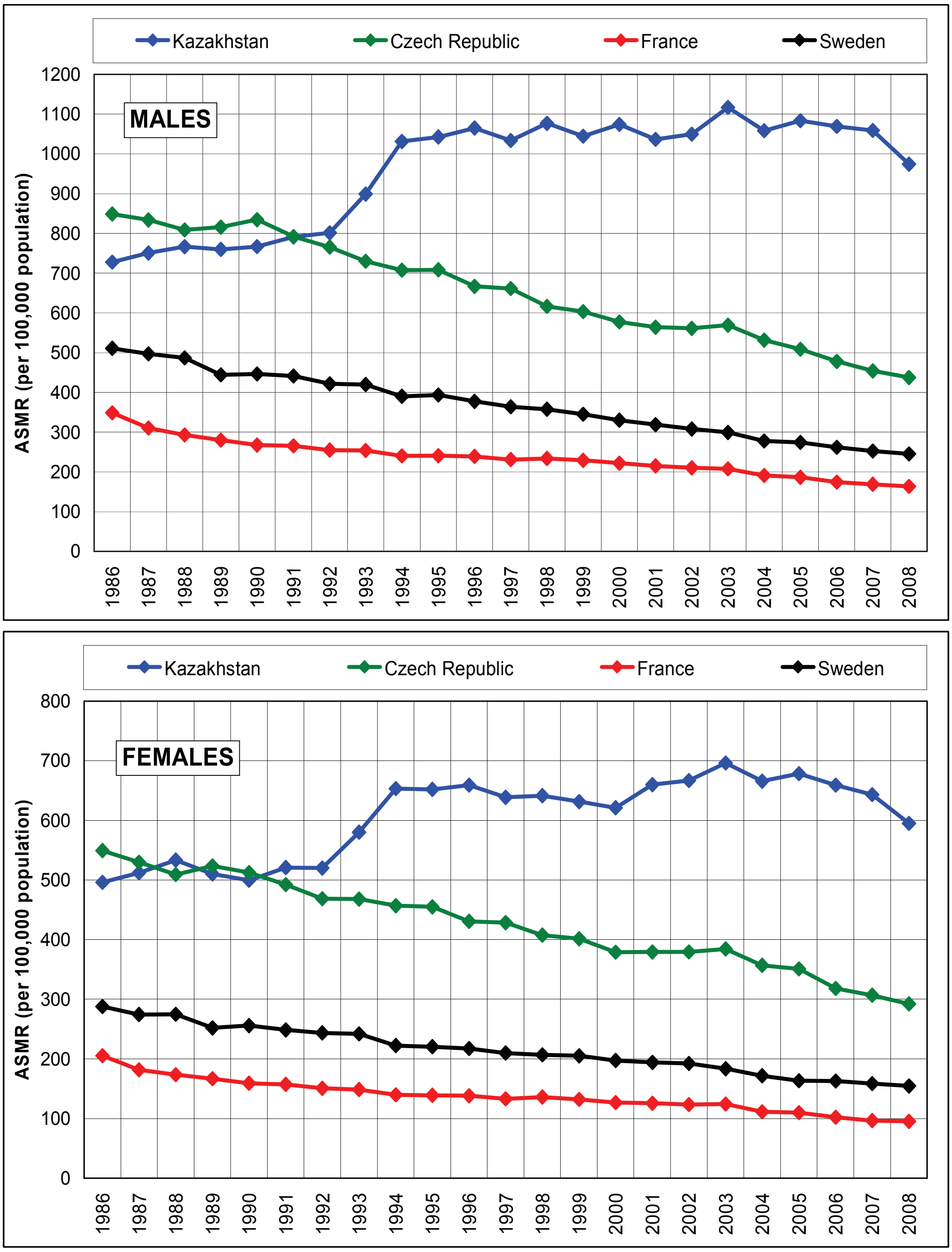
Figure 3: Continued



Source: Author's calculations based on data from WHO MDB

The intensity of mortality by cause of death from circulatory diseases among males is higher than females, as can be seen from Figure 4, the highest male standardized mortality rates from circulatory diseases were found in Kazakhstan and the Czech Republic at the beginning of analysis. We can see that in 1986 Kazakhstan had more favorable mortality situation in both sexes than the Czech Republic. However, we should mention the fact about quality of mortality data in Kazakhstan at that time period, which can not be count as reliable one. The sharply changes in the following decade can prove that fact easily. Kazakhstan mortality from circulatory diseases began increasing in both sexes, but the increase in men's ASMR was more dramatic, and did not even get the level of 1986. We can assume that this growth was linked to the decay of the health care system after the collapse of the Soviet Union. A comparison with the Czech Republic reveals how effective implementation of public health campaigns can be, showing a great potential for rapid decline: CVD is far more sensitive to policy changes than cancer, for example (Sans et al. 1997). Males and females show the same patterns. The Czech Republic improved its mortality intensity by cause of death from circulatory diseases in 1990s and shows only declining, trying to reach the level of Sweden and France, which show the lowest ASMR among the selected countries. Therefore, we suppose that mortality from circulatory diseases is closely connected with socio-economic conditions, lifestyle, public health policy and accessible and effective health care. These examples show that the level of diagnostics, availability of appropriate material and technical equipment, qualification of physicians, especially in the sphere of diagnostics, affected the development of the leading causes of death. Cardiology in general is not on a sufficient level in Kazakhstan. This results in such high mortality rates from CVD in Kazakhstan (Kulzhanov and Rechel 2007).

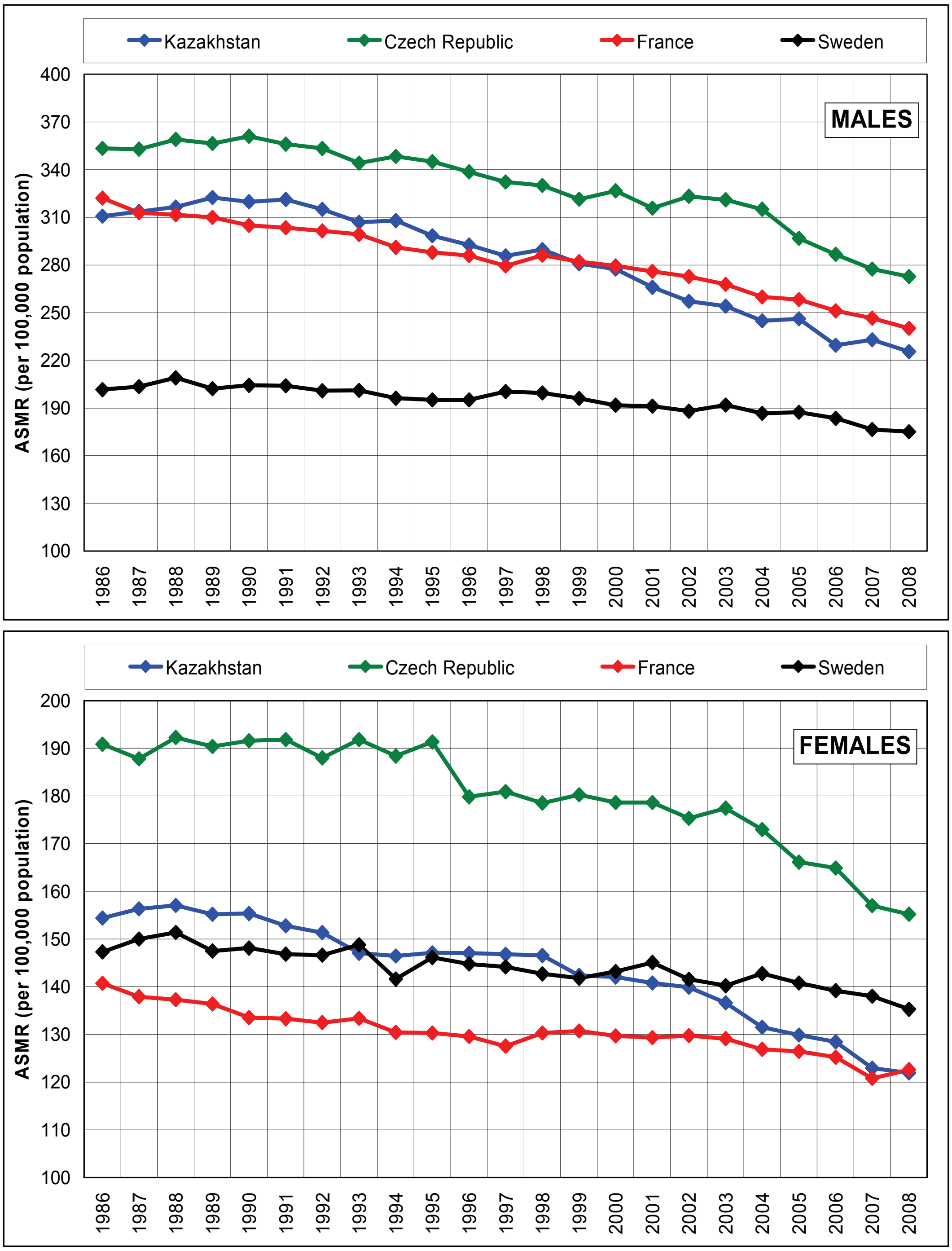
Figure 4: Age-standardized mortality rates from circulatory diseases (per 100,000 population) in the selected countries, males and females, 1986-2008



Source: Author's calculations based on data from WHO MDB

According to Figure 5, the intensity of mortality by cause of death from neoplasms in Kazakhstan was lower than in the Czech Republic in both sexes, where we see the highest age-standardized mortality rates during the whole period. Kazakhstan shows the similar trends like France among males, the lowest ASMR belongs to Sweden. There was a little bit different situation among females, till 2000 Kazakhstan reveals almost identical trend like Sweden, but after that period we can observe decline in mortality from neoplasms, and Kazakhstan reveals the lowest ASMR (122.0 per 100,000 inhabitants) from this cause of death, the same mortality rate was observed in France (123.0 per 100,000 inhabitants) in 2008. We have to mention that France presents the lowest mortality intensity from neoplasms among females throughout the period under observation.

Figure 5: Age-standardized mortality rates from neoplasms (per 100,000 population) in the selected countries, males and females, 1986-2008



Source: Author’s calculations based on data from WHO MDB

The respiratory diseases include: asthma, tuberculosis, bronchiolitis, emphysema, cystic fibrosis, influenza and pneumonia. Kazakhstan experienced a decrease in mortality from respiratory diseases over the past decades (see Figure 6). The age-standardized mortality rates for men in Kazakhstan vary between 100.0 and 220.0 deaths per 100,000 inhabitants, while in the selected European countries it is less than 100.0 deaths per 100,000 inhabitants throughout the whole period. The main reason for the high rates of respiratory diseases is increasing smoking and ecological problems such as air pollution. For women of the selected European countries the rates vary between 18.0 and 50.0 per 100,000 inhabitants in the time period of 1986-2008, while in Kazakhstan it is 35.0 and 85.0 per 100,000 inhabitants. The trends patterns are rather similar for men and women. High values are noticeable in Kazakhstan. The negative position of Kazakhstan in 1995 was particularly striking (males ASMR 220.3 per 100,000 inhabitants, females ASMR 83.2 per 100,000 inhabitants). The main source of problem is the Aral Sea. It had acted as a giant climate buffer, due to it, summers got hotter and winters colder. Left behind was a salty surface almost 300 kilometers wide, contaminated with pesticides from decades of agricultural run off. Every few weeks, violent dust storms send hundreds of tonnes of salt, sand and chemicals into the air, and into people’s lungs. Throat cancer and respiratory diseases have become widespread and as there is no reliable protein source in the absence of fish, thousands of people become anemic (Walters 2010).

Figure 6: Age-standardized mortality rates from respiratory diseases (per 100,000 population) in the selected countries, males and females, 1986-2008

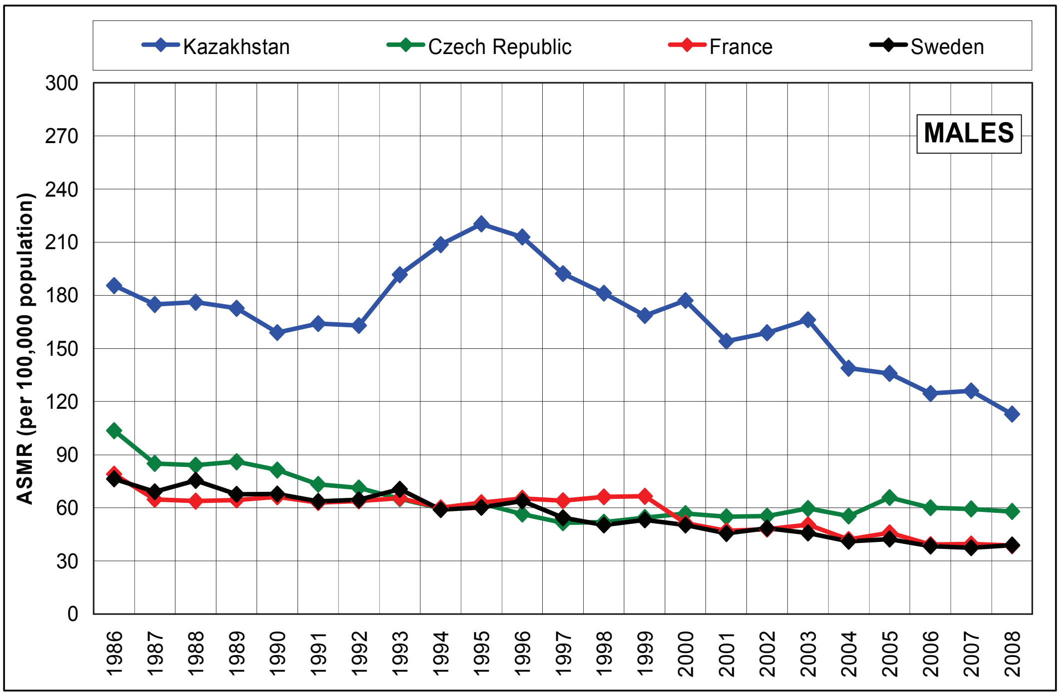
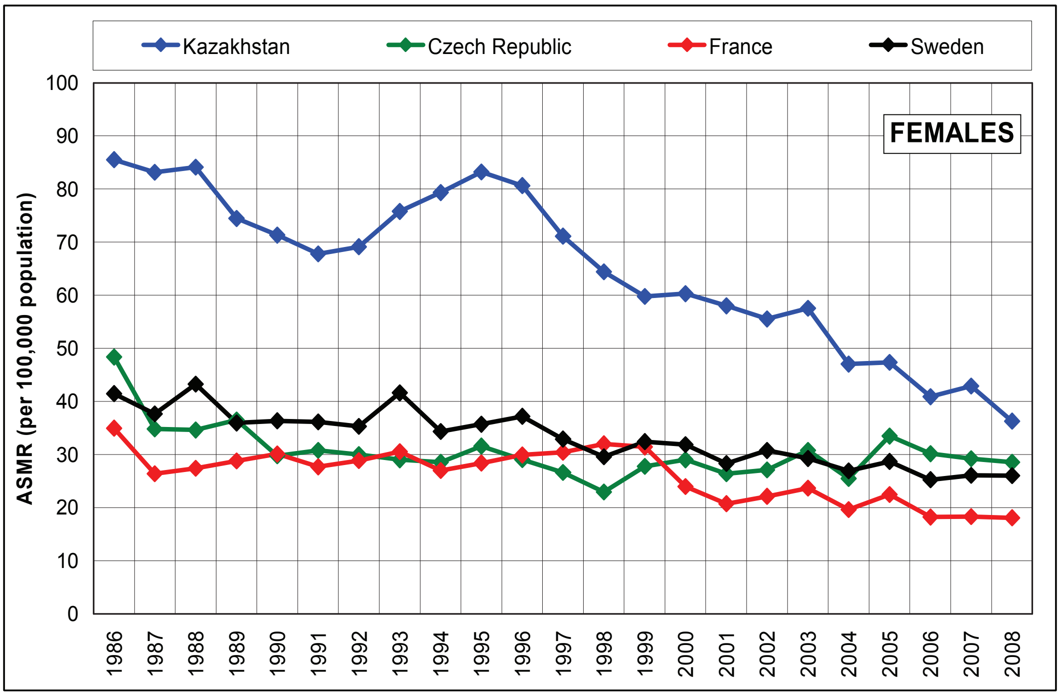


Figure 6: Continued

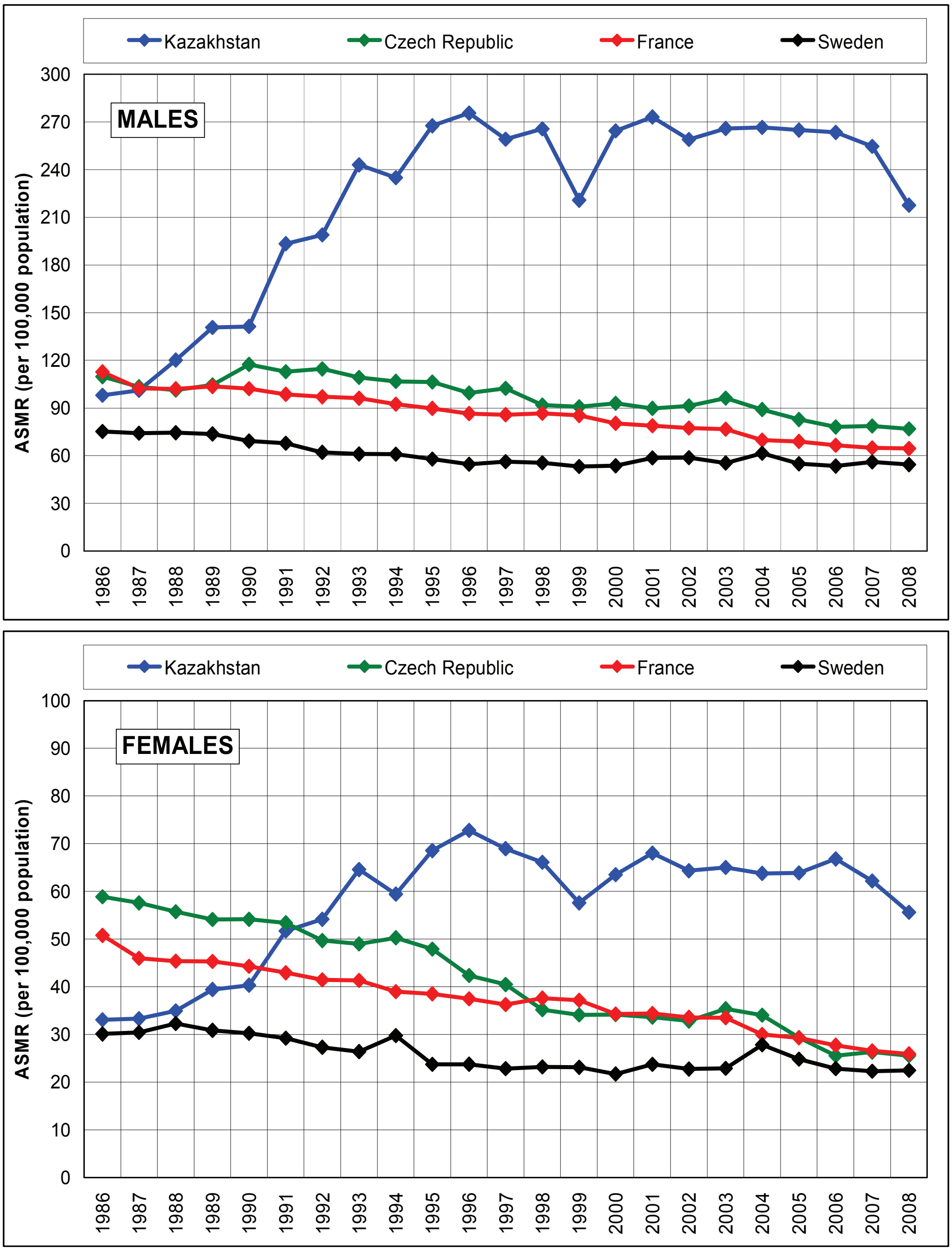


Source: Author's calculations based on data from WHO MDB

Mortality intensity by cause of death from external causes is constituted by the following components: traffic accidents, motor vehicle traffic accidents, accidental falls, accidental drowning and submersion, exposure to smoke, fire and flames, accidental poisoning, suicides and self-inflicted injures and others. According to our charts 3-10, we can say that external causes have a social dimension, as indicators of welfare in society. The evolution of mortality from external causes in Kazakhstan over the past 22 years can be divided into several periods: a relatively stable development until the late 1980s; a sharp growth that began with dynamics of deaths from external causes repeating the pattern of overall mortality of the population of the region, a significant increase since taking independence in 1991.

Then the relative stabilization at the end of the 1990s. ASMR from this class of causes in Kazakhstan almost doubled in 2008 (males ASMR 217.6 per 100,000 inhabitants, females ASMR 55.6 per 100,000 inhabitants) compared with 1986 (males ASMR 98.0 per 100,000 inhabitants, females ASMR 33.1 per 100,000 inhabitants). It is mostly explained by the increasing accidental deaths. Another reason of such a high level of ASMR in Kazakhstan compared with the selected European countries is due to high levels of alcohol consumption. For women among the selected countries the gap is not so great, although differences were also unfavorable for Kazakhstan. Mortality from external causes for both men and women has been growing in Kazakhstan, but for females at a much slower pace than for males. After the end of the Soviet Union, the number of imported cars from Europe, USA and Japan into Kazakhstan increased every year, which led to an increase in deaths from traffic accidents in Kazakhstan. Moreover, with the collapse of the Soviet Union Kazakhstan experienced a collapse of industrial production. Trends found among males of the selected European countries were stable, without any big fluctuations (Figure 7). Concerning females, we can see that there was a small gap in ASMR values from external diseases between the Czech Republic, France and Sweden throughout the selected time period, but in 2008 they had almost the identical age-standardized mortality rates from external diseases, the trends among males reveal the same situation. Although, Sweden shows the most favorable trends among the selected countries in both sexes during the studied period.

Figure 7: Age-standardized mortality rates from external diseases (per 100,000 population) in the selected countries, males and females, 1986-2008



Source: Author's calculations based on data from WHO MDB

ASMR from digestive diseases of Kazakhstan men (around 57.7 per 100,000 in 1987) and women (31.8 per 100,000 in 1986) were similar to the Czech Republic and France' levels at the same time period (see Figure 8). The lowest mortality rates among the selected European countries were found out in Sweden, in both sexes. If lack of sanitary culture in a society is one of the main reasons of infectious diseases, the diseases of digestive system are more complicated to deal with, since it is impossible to discern one single reason. There are multiple factors such as influence of nervous overload, violation of the regime, the quality of food, insufficient physical activity, psychological trauma, etc. These environmental factors (low physical activity, nervous tension), and by themselves, without the prior intestinal infection, may contribute to the development of chronic diseases of the digestive system (Go et al. 2001). However, the increase can also be attributed to poor quality of drinking water. Till the early 1990s Kazakhstan males and females ASMR from digestive diseases had insignificant differences between the Czech Republic and France, but after that period ASMR from digestive diseases among both sexes constantly increased. And in 2008 Kazakhstan shows the highest ASMR in both sexes among the selected countries. The main reasons of such development of these diseases are economic and political crises, which appeared after the collapse of the Soviet Union. The Czech Republic shows modest trends of digestive diseases throughout the selected time period in both sexes. France shows the decrease of ASMR from digestive diseases in both sexes, and nearly approached the level of Sweden in 2008. We have to stress the fact that Sweden reveals the favorable ASMR trends among males and females throughout the studied period.

Figure 8: Age-standardized mortality rates from digestive diseases (per 100,000 population) in the selected countries, males and females, 1986-2008

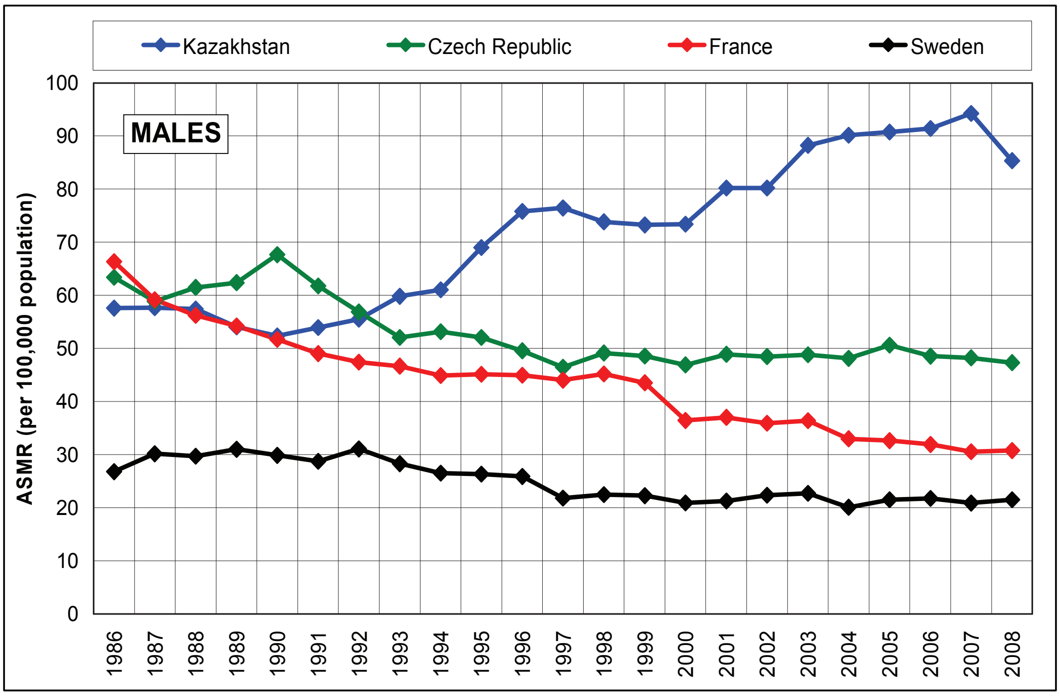
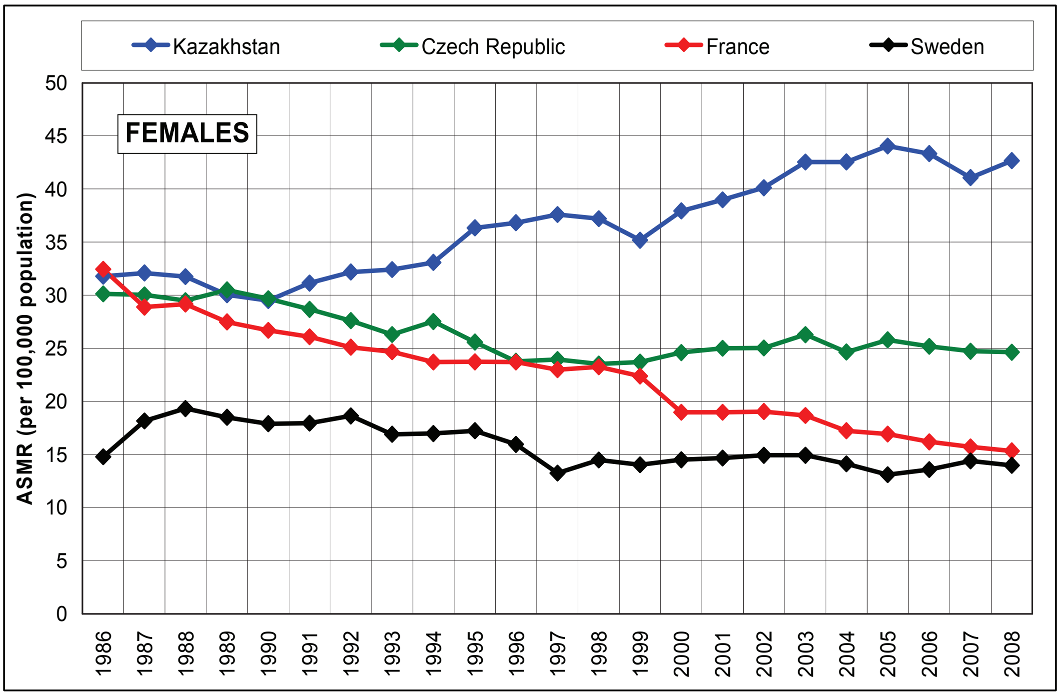


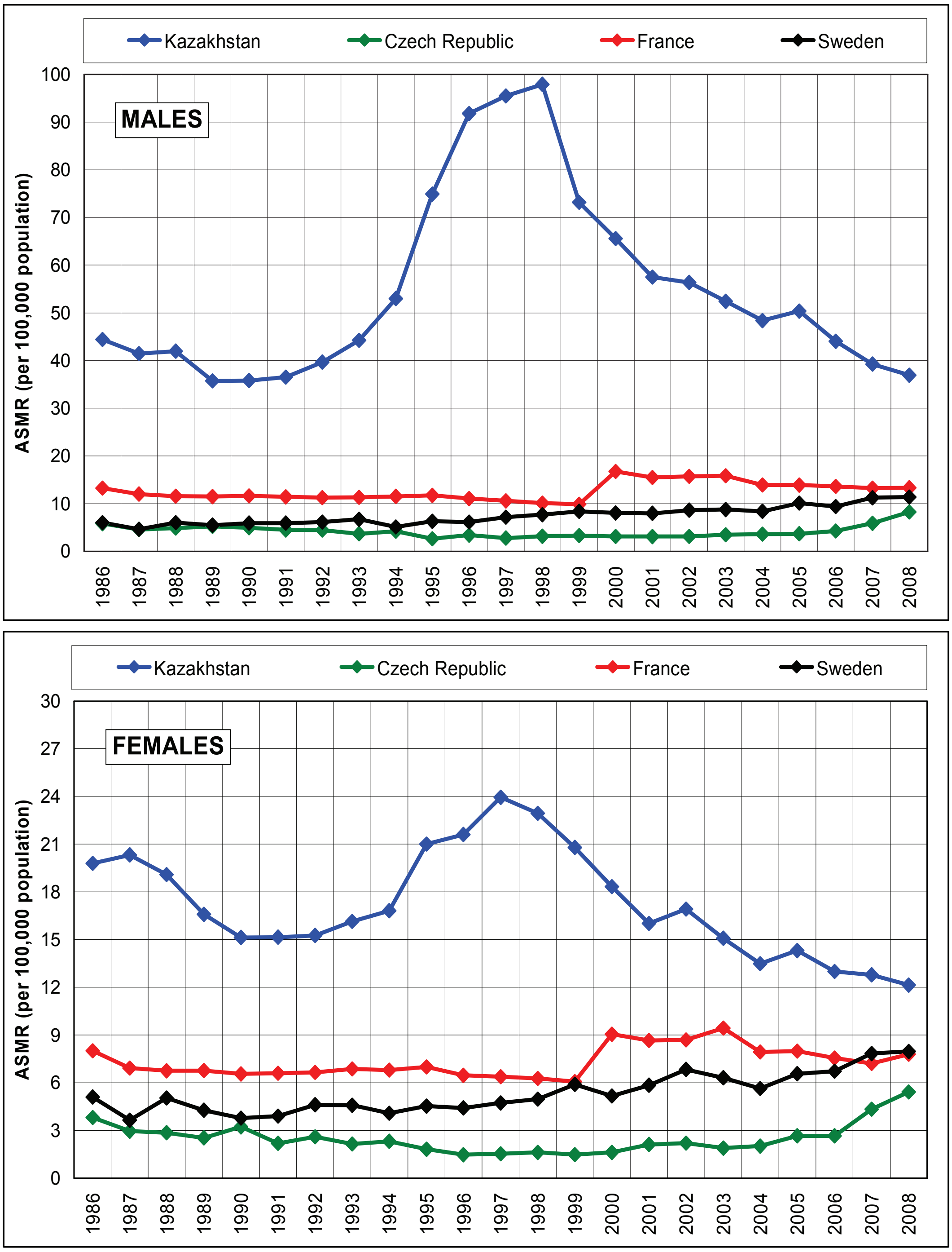
Figure 8: Continued



Source: Author's calculations based on data from WHO MDB

In the second half of the 1980s, mortality from infectious diseases in Kazakhstan was significantly higher among men and women than in the selected European countries (Figure 9). However, in the subsequent years a decline was observed, that lasted until the early 1990s. Since 1990, there was a rapid growth probably related to the collapse of the Soviet Union and an economic crisis. J. Klugman and G. Schieber pointed out in their research that infectious diseases generally were not important in determining the health of general population. Tuberculosis may have been an exception (Klugman and Schieber 1996). Tuberculosis mortality on average accounted for more than half of total mortality from infections in Kazakhstan. As the decreasing trends reversed in the 1990s, infectious diseases contributed to the fall of life expectancy. It is possible that a part of the deaths registered as being due to tuberculosis should be attributed to AIDS that became widespread in 1990s and continued to rise in the 2000s (UNICEF 2004). Until the year 2000 the situation of infectious diseases in Kazakhstan should be characterized as serious and rapidly growing, but after 2000 there was a sign of decrease. Such a high level of ASMR by infectious diseases in Kazakhstan, compared with other selected European countries, was due to a high share of prisoners. According to the data of the world prison population list in 2005, the number of persons per 100,000 inhabitants in Kazakhstan amounted to 386 (Walmsley 2007). The Czech Republic shows the lowest ASMR among the selected countries in both sexes, Kazakhstan shows the highest rates, with the peak in 1998 (97.9 per 100,000 inhabitants) for males, and in 1997 (24.0 per 100,000 inhabitants) for females. We can say that the selected European countries in comparison with Kazakhstan do not show such big fluctuations in trends, mostly the trends are steady.

Figure 9: Age-standardized mortality rates from infectious diseases (per 100,000 population) in the selected countries, males and females, 1986-2008



Source: Author's calculations based on data from WHO MDB

Although the described diseases cover most of the deaths, some other diseases (residual) should be mentioned too. This group of causes comprises unknown and unspecified causes as well as sudden infant death syndrome. Modern lifestyles and nutrition, combined with physical inactivity are described as risk factors of other causes. With increasing age, the incidence also rises, for example, in the case of diabetes (Gojka et al. 2000). The Figure 10 shows the development of ASMR by all other (residual) causes of death. In the period prior to 1991, the trends of Kazakhstan and Sweden were broadly similar to the Czech Republic. We can see that the Czech Republic shows the lowest ASMR among the selected countries in males and in females. At the beginning, till the early 1990s France shows the highest mortality rates from other causes of death. At the same time period, the other causes as well as overall mortality sharply increased in Kazakhstan. The result of this changes was due to a weakening of the health system. It was at the time when Kazakhstan faced new threats and challenges, such as economic crisis. In 2008, we can see that the selected countries took the following places, in both sexes the structure of ranking are identical, the highest ASMR belongs to Kazakhstan, then follows France, and Sweden takes the third position, the lowest and favorable rates are found out in the Czech Republic.

Generally, we can see an increase in mortality from all other causes of death in the early 1990s in Kazakhstan. Anyway, the trend in Kazakhstan normalized after 2000. The root of the problem is that in the post-communist society, population was an extremely low priority, which is reflected in all discussed causes of death.

Figure 10: Age-standardized mortality rates from other (residual) diseases (per 100,000 population) in the selected countries, males and females, 1986-2008

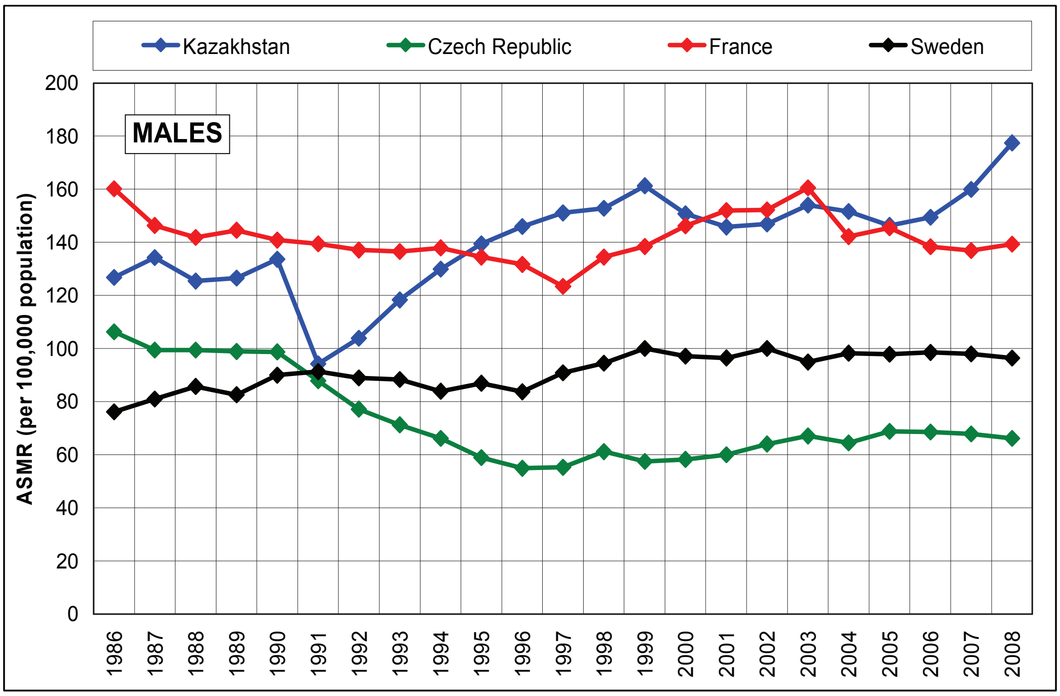
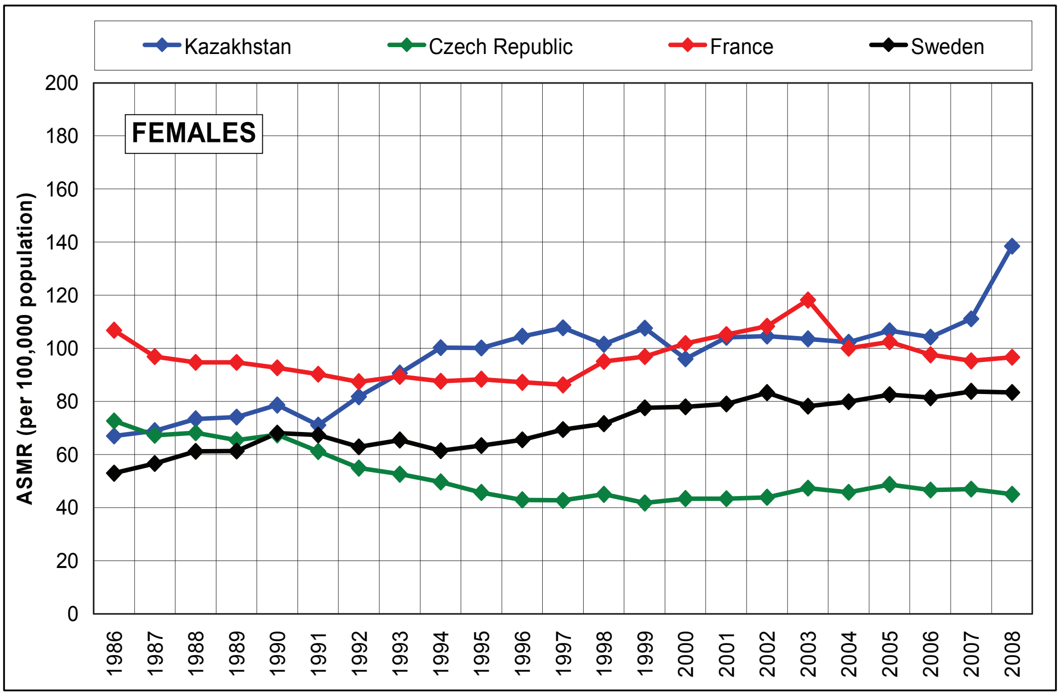


Figure 10: Continued



Source: Author's calculations based on data from WHO MDB

The method of decomposing mortality rates into changes in life expectancy at birth is commonly used in demographic literature to analyze several year time intervals. This allows to translate the immediate influence of changes in lifestyle and socio-political living conditions into age and disease specific contributions to short-term changes in life expectancy at birth. We use decomposition of the gap in life expectancy by age and the main causes of death in 2008. The selected main causes are: circulatory diseases, neoplasms, respiratory diseases, external diseases, diseases of the digestive system, infectious diseases and others (residual) group of diseases. In the results of these analyses we will examine the contributions of deaths at different ages and from the selected causes to the total life expectancy gap between the sorted two countries. Kazakhstan will be reference country as a standard in both sexes, for males and females. Regarding to the aim of this thesis, it is to contrast cause-specific mortality settings in Kazakhstan to the selected European countries. All the selected countries were chosen for the decomposition method and separated by sex. Sweden and France represent low mortality populations. Sweden has the highest life expectancy among males in 2008, and France has the highest life expectancy among females at the given year.

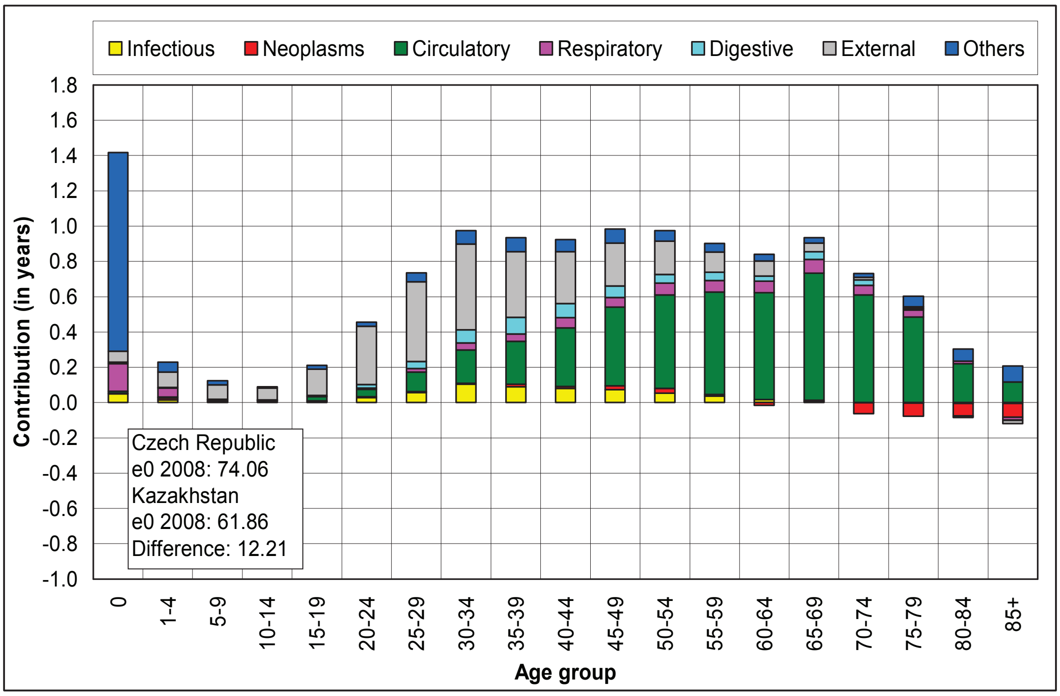
Figure 11 shows that the gap in the life expectancy at birth for males in the Czech Republic and Kazakhstan is 12.21 years with the greatest contribution being made by differences between infant mortality and mortality rates at ages from 25 to 80 years of age. Excess male mortality in Kazakhstan from diseases of the circulatory system plays a crucial role at ages between 40 and 80 years old. At younger ages external causes of death play a major part. The contribution made by the digestive system diseases and other diseases are considerable, but much less significant than those of circulatory system diseases and external causes. Neoplasms and respiratory system diseases contribute even less. Infectious diseases affect mainly infant age group and ages from

25 to 50 years of age. All causes of death at old ages (70-85+) actually make a negative contribution.

According to Figure 12 the gap in the life expectancy at birth in France and Kazakhstan males is very significant - 16.0 years in 2008. Higher intensity of mortality of the diseases of the circulatory system in Kazakhstan plays a role at senior ages, while in the younger ages are external causes. The contribution made by diseases of the digestive system, respiratory system and infectious diseases is insignificant. Other diseases comprise major part in comparison with other causes of death at age group 0, for the selected causes mainly occur at older ages. A negative contribution at older ages mainly from neoplasms causes of death is lower in Kazakhstan males than among France males.

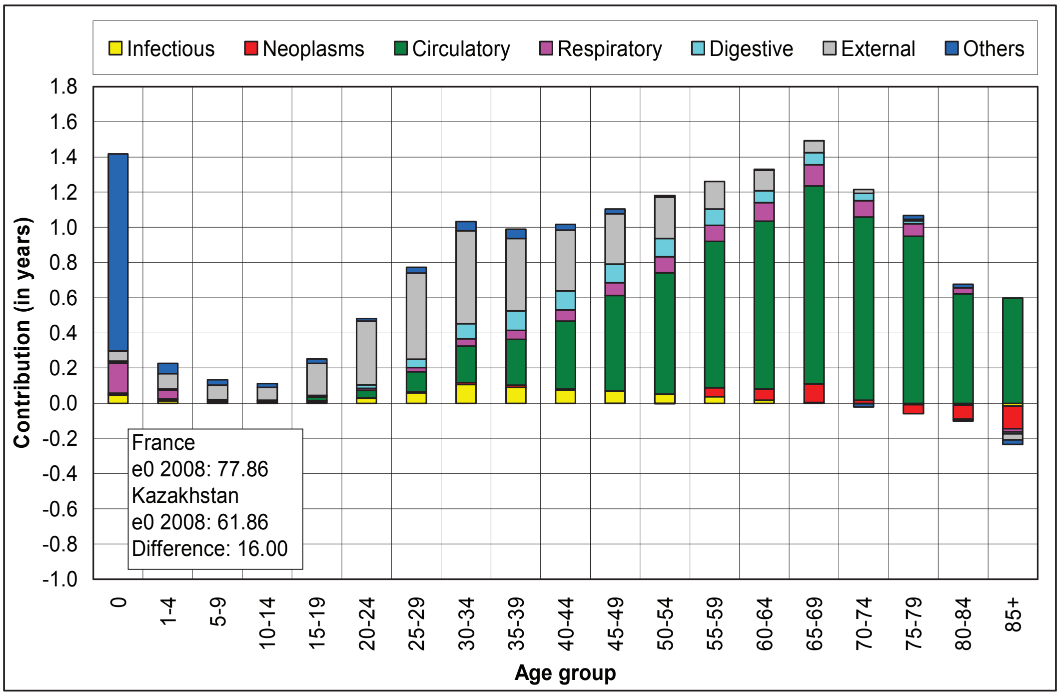
The difference between expectation of life at birth among males of Sweden and Kazakhstan is equal to 17.28 in 2008 (see Figure 13). It is the largest gap of life expectancy at birth among the selected countries. The biggest contribution being made by differences between mortality rates at ages 25 and over, and especially infant mortality as well as in comparison with the selected countries is high. The diseases of circulatory system, which play significantly role is higher in Kazakhstan at ages between 50 and 80. Neoplasms compared with the circulatory diseases affect less. A major part is influenced at younger ages by external causes of death. The contribution made by other selected causes of death less. Cancer diseases at older ages show a negative contribution, being lower in Kazakhstan than in Sweden in 2008.

Figure 11: Decomposition of the Czech Republic-Kazakhstan gap in life expectancy at birth by age and main causes of death, males, 2008



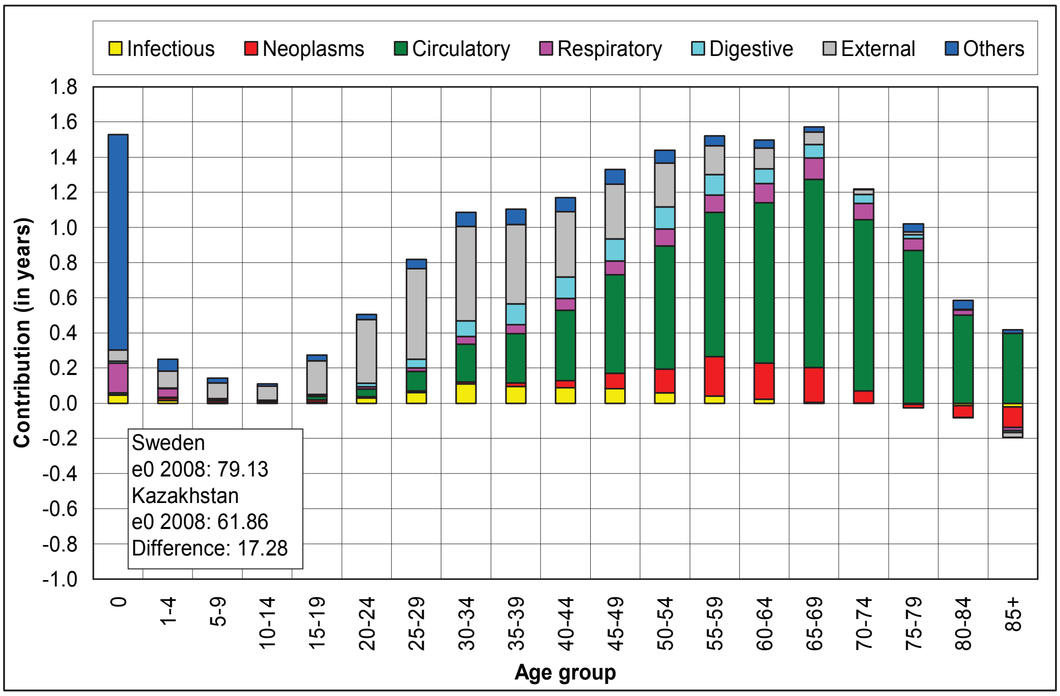
Source: Author's calculations based on data from WHO MDB

Figure 12: Decomposition of France-Kazakhstan gap in life expectancy at birth by age and main causes of death, males, 2008



Source: Author's calculations based on data from WHO MDB

Figure 13: Decomposition of Sweden-Kazakhstan gap in life expectancy at birth by age and main causes of death, males, 2008



Source: Author's calculations based on data from WHO MDB

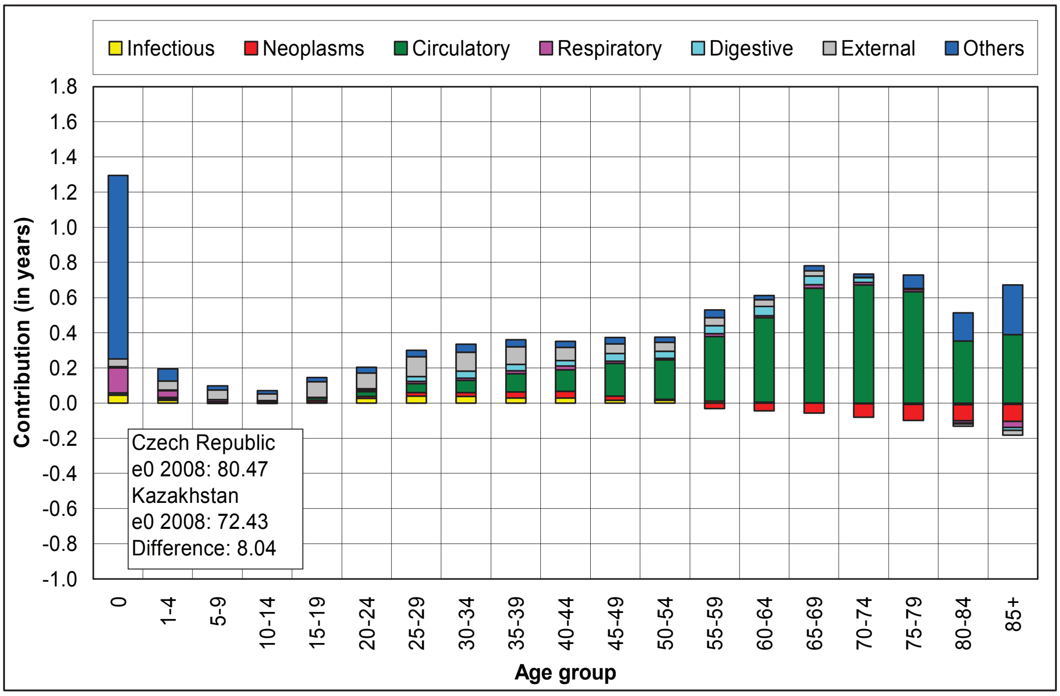
The contribution of age groups and main causes of death to the difference in life expectancy at birth for females population in 2008 was analyzed. Figure 14 illustrates the result of the decomposition of life expectancy by age and selected causes of death between females of the

Czech Republic and Kazakhstan in 2008. The gap in expectation of life at birth between these two countries is equal to 8.04 years. Its structure by age and causes of death is quite similar among young ages, especially in 5-9 and 15-19 age groups. Excess mortality in Kazakhstan from diseases of the circulatory system plays a major role at adult and older ages. A great deal of contribution shows infant age group, where other diseases are denominator, then respiratory diseases follow. The contribution made by digestive and neoplasms are important too.

According to Figure 15 the gap in life expectancy at birth between French women and Kazakhstani ones is 12.37 years in 2008 and its structure by age and causes of death is quite different from that for males. The greatest contribution to the difference in expectation of life at birth is from higher level of mortality in Kazakhstan at ages 55 and 85+. Circulatory diseases and external causes of death play a much greater role at ages 25 and 50, with smaller contributions from digestive, infectious and respiratory diseases. Also a large contribution from others and respiratory causes of death at infant ages are noted.

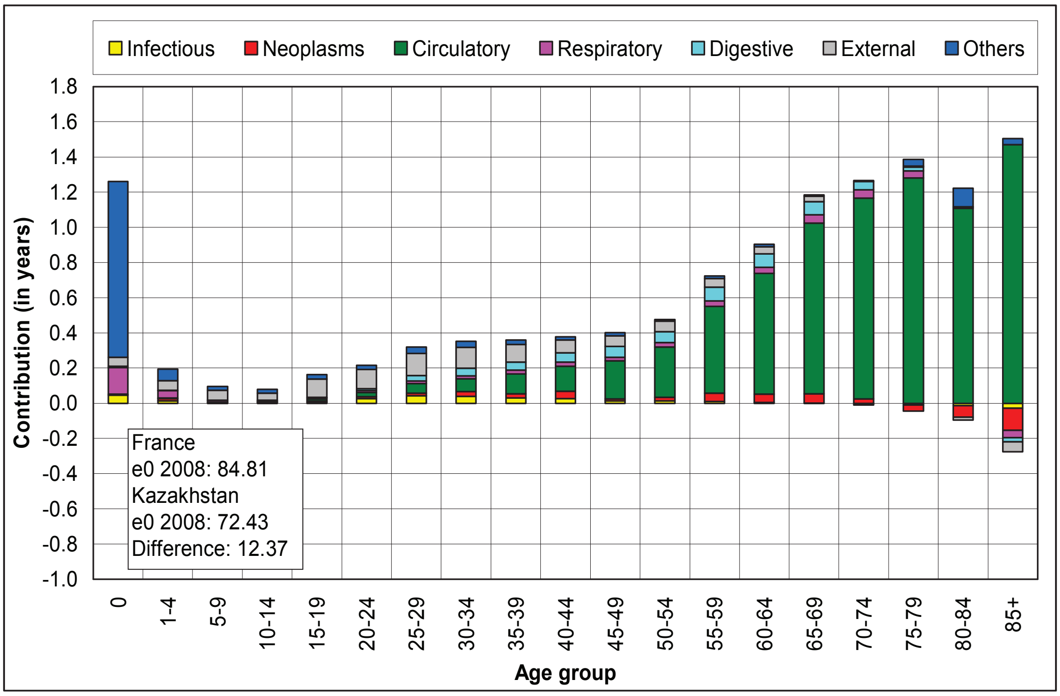
For females the gap in life expectancy at birth between Sweden and Kazakhstan is 10.75 years in 2008 (see Figure 16). The largest contribution to the overall life expectancy gap is from higher intensity of mortality in Kazakhstan at ages 55 and over. External causes of mortality at 20 ages and 50 ages are considerable, but from lower to higher age groups they are less significant than the causes of circulatory system diseases. All the groups of death make a negative contribution at oldest ages, which means that values of these remaining causes of death are lower in Kazakhstan rather than in Sweden in the same time period. The result of French females has some common characters with Sweden females in contributions to Kazakhstani women.

Figure 14: Decomposition of the Czech Republic-Kazakhstan gap in life expectancy at birth by age and main causes of death, females, 2008



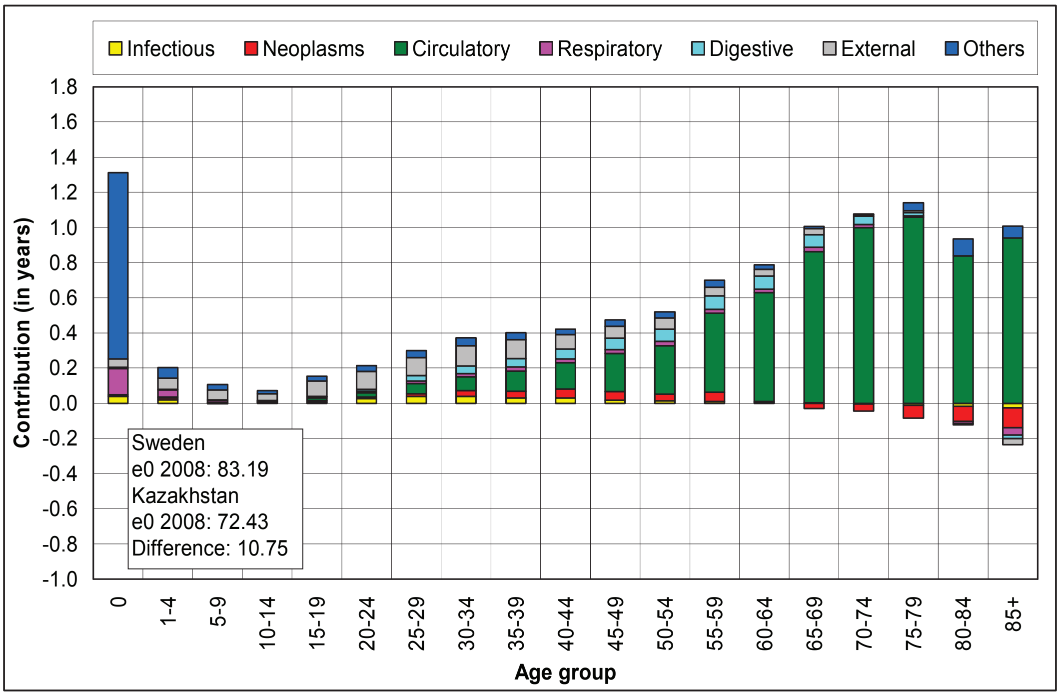
Source: Author's calculations based on data from WHO MDB

Figure 15: Decomposition of France-Kazakhstan gap in life expectancy at birth by age and main causes of death, females, 2008



Source: Author's calculations based on data from WHO MDB

Figure 16: Decomposition of Sweden-Kazakhstan gap in life expectancy at birth by age and main causes of death, females, 2008



Source: Author's calculations based on data from WHO MDB

In summary, decomposition of gap in life expectancy at birth by age and main causes of death for males among the selected countries in 2008 showed the following picture. The highest expectation of life at birth was found among men in Sweden e_0=79.13, among women in France

e_0=84.81. The lowest was in Kazakhstan, and was equal to e_0=61.86 among males and e_0=72.43 among females. The selected European countries and Kazakhstan contribution to the life expectancy for men is significant between young and adult ages. In France-Kazakhstan, and in Sweden-Kazakhstan for males a similar pattern was observed, in both cases the greatest contribution was at adult ages. Also the gap between life expectancies at birth for males was more than 15 years. Moreover, in the both cases important role play the diseases of the circulatory system and external causes of mortality and morbidity. Female pattern was a little bit different from males and has the same causes of death and period of time. The Czech Republic-Kazakhstan decomposition shows negative results at adult and older ages from cancer diseases. The similarities in structure by age and causes of death were observed among France-Kazakhstan, and Sweden-Kazakhstan. The greatest contribution was at adult and older ages in these countries, and diseases of the circulatory system played a major role. Also in both cases a negative contribution at oldest ages was noted. Both for males and females, the large contribution at infant ages were common feature that is once more evidence that IMR in Kazakhstan is at very high level.

Here we analyse the years of potential life lost, it is a measure that highlights premature, preventable, and unnecessary mortality, which focuses on death before age 75. According to Table 19 in Kazakhstan, 1,000 men lose in average 214.1 YPLL in 1986. The lower figures are found in all the selected European countries. In 1997 we can see increase in values of YPLL in Kazakhstan, while other countries show decline in rates. In 2008 we can see that Kazakhstan reveals 245.1 YPLL from overall mortality, while other countries have the rate of YPLL less than 100.0. From data presented in Table 19, one can find YPLL from main causes of death, sorted by the selected years, with included Index, and also additional data in Annex (Figure A3). Circulatory diseases, neoplasms, external causes, and other diseases comprise a huge amount of YPLL among males in the selected countries. The highest values were observed in Kazakhstan due to loss from all the main groups of causes, except neoplasms, almost during the whole period under observation. The highest rates of YPLL from neoplasms was found out in the Czech Republic, the lowest in Sweden during the whole period. Kazakhstan and France reveal almost similar values in YPLL from cancer mortality during the same period.

Table 19: Years of potential life lost from main groups of causes of deaths (per 1,000 persons) in the selected countries, males, selected years

Country	**MALES**					
	YPLL			**Index (%)**		
	1986	**1997**	**2008**	**1997/1986**	**2008/1997**	**2008/1986**
	Overall mortality					
Kazakhstan	214.1	260.9	245.1	122	94	114
Czech Republic	139.0	115.8	92.9	83	80	67
France	108.4	86.2	70.8	80	82	65
Sweden	84.6	61.0	51.7	72	85	61
	Circulatory diseases					
Kazakhstan	31.0	57.0	61.2	184	107	197
Czech Republic	44.5	35.5	24.5	80	69	55
France	17.2	12.6	9.5	73	75	55
Sweden	26.9	16.7	11.8	62	71	44

Table 19: Continued

	Neoplasms					
Kazakhstan	23.5	21.5	17.6	92	82	75
Czech Republic	32.6	31.0	25.8	95	83	79
France	28.4	25.9	22.9	91	88	81
Sweden	16.3	15.2	13.5	94	88	83
	Respiratory diseases					
Kazakhstan	42.6	26.2	14.5	34	61	55
Czech Republic	6.4	3.8	4.0	62	59	105
France	3.2	2.6	1.7	53	82	64
Sweden	3.5	1.6	1.6	45	45	100
	External diseases					
Kazakhstan	32.0	78.6	75.4	246	96	236
Czech Republic	25.3	27.9	20.3	110	73	80
France	29.2	22.3	15.2	76	68	52
Sweden	20.9	13.6	12.9	65	95	62
	Digestive diseases					
Kazakhstan	6.0	9.8	14.0	234	164	143
Czech Republic	7.9	7.3	7.5	96	92	104
France	6.5	4.8	3.6	56	75	75
Sweden	2.7	1.9	2.1	77	70	111
	Infectious diseases					
Kazakhstan	18.5	30.7	11.5	166	38	62
Czech Republic	0.7	0.5	0.8	62	175	109
France	1.2	0.9	1.5	70	174	122
Sweden	0.8	0.8	0.8	108	96	104
	Other diseases					
Kazakhstan	60.5	37.1	50.9	61	137	84
Czech Republic	21.6	9.8	10.0	45	102	46
France	22.7	17.1	16.4	75	96	72
Sweden	13.5	11.2	9.0	83	81	67

Source: Author's calculations based on data from WHO MDB

According to Table 20, females in Kazakhstan show the same trends of YPLL among the selected countries. Kazakhstan reveals the highest YPLL rate throughout the whole period. In 1986 it was equal to 127.1 YPLL, then we observe decline in 1997 and in 2008, but it decreases not less than 112.8 per 1,000 persons in 2008, while other countries do not prevail more than 50 YPLL. Concerning YPLL from main groups of causes among females in Kazakhstan, we observe similar trends like in the case of males. Major part of YPLL comprise circulatory, respiratory, external, infectious and other diseases during the whole period. Comparing recent values of YPLL from circulatory diseases, we observe that it was equal to 26.3 per 1,000 persons, while YPLL do not prevail much than 10.0 per 1,000 persons in the selected European countries at the same year. Loss due to neoplasms was the highest among the Czech Republic during the whole period, Kazakhstan, France and Sweden reveal the similar values at the same period under observation. YPLL from respiratory diseases significantly declined in Kazakhstan during the period of 1986-2008. YPLL from external causes increased in Kazakhstan during past two decades, while the other countries show reduction from this cause of death. YPLL due to digestive diseases steadily decline only in France. Among females of Kazakhstan and the

Czech Republic we see increasing values, and in case of Sweden it was unchangeable throughout the whole studied period. Infectious diseases in Kazakhstan play great role in YPLL, values are not lower than 4.7 in 2008, while other countries reveal less than 1.0 YPLL, and the highest YPLL from other diseases belong to Kazakhstan during the whole period.

Table 20: Years of potential life lost from main groups of causes of deaths (per 1,000 persons) in the selected countries, females, selected years

Country	FEMALES					
	YPLL			Index (%)		
	1986	1997	2008	1997/1986	2008/1997	2008/1986
	Overall mortality					
Kazakhstan	127.1	119.6	112.8	94	94	89
Czech Republic	70.7	54.6	44.0	77	81	62
France	49.3	38.8	34.2	79	88	69
Sweden	46.1	36.4	32.8	79	90	71
	Circulatory diseases					
Kazakhstan	18.1	29.1	26.3	160	91	145
Czech Republic	20.0	15.6	9.5	78	61	47
France	6.4	4.5	3.6	70	81	57
Sweden	9.5	6.4	4.5	68	70	48
	Neoplasms					
Kazakhstan	16.0	15.6	14.5	98	93	91
Czech Republic	21.2	20.0	17.9	95	89	85
France	14.6	14.1	14.3	96	102	98
Sweden	16.9	15.4	14.6	68	70	48
	Respiratory diseases					
Kazakhstan	32.1	14.9	7.0	46	47	22
Czech Republic	3.0	1.9	2.0	62	103	64
France	1.6	1.2	0.7	79	60	48
Sweden	2.0	1.3	1.2	66	92	61
	External diseases					
Kazakhstan	10.2	21.1	19.4	207	92	189
Czech Republic	7.5	7.0	5.2	94	74	69
France	9.7	7.2	4.6	74	64	47
Sweden	7.1	4.9	4.6	68	94	64
	Digestive diseases					
Kazakhstan	3.6	4.7	6.7	131	143	187
Czech Republic	2.9	2.8	3.1	94	114	108
France	3.0	2.1	1.5	72	70	51
Sweden	1.1	0.9	1.2	77	133	102
	Infectious diseases					
Kazakhstan	13.5	9.9	4.7	73	47	35
Czech Republic	0.5	0.3	0.5	53	182	97
France	0.8	0.5	0.7	66	141	94
Sweden	0.6	0.4	0.6	70	126	88
	Other diseases					
Kazakhstan	33.6	24.3	34.2	72	140	102
Czech Republic	15.6	7.0	5.8	45	82	37
France	13.2	9.2	8.8	69	97	67
Sweden	8.9	7.1	6.1	80	86	69

Source: Author’s calculations based on data from WHO MDB

Table 21: Structure of years of potential life lost from main groups of causes of deaths (in %) in the selected countries, males and females, selected years

Country	MALES YPLL			FEMALES YPLL		
	1986	1997	2008	1986	1997	2008
	Overall mortality					
Kazakhstan	100.0	100.0	100.0	100.0	100.0	100.0
Czech Republic	100.0	100.0	100.0	100.0	100.0	100.0
France	100.0	100.0	100.0	100.0	100.0	100.0
Sweden	100.0	100.0	100.0	100.0	100.0	100.0
	Circulatory diseases					
Kazakhstan	14.5	21.8	25.0	14.2	24.3	23.3
Czech Republic	32.0	30.7	26.4	28.3	28.6	21.6
France	15.9	14.6	13.4	13.0	11.6	10.5
Sweden	31.8	27.4	22.8	20.6	17.6	13.7
	Neoplasms					
Kazakhstan	11.0	8.2	7.2	12.6	13.0	12.9
Czech Republic	23.5	26.8	27.8	30.0	36.6	40.7
France	26.2	30.0	32.3	29.6	36.3	41.8
Sweden	19.3	24.9	26.1	36.7	42.3	44.5
	Respiratory diseases					
Kazakhstan	19.9	10.0	5.9	25.3	12.5	6.2
Czech Republic	4.6	3.3	4.3	4.2	3.5	4.5
France	3.0	3.0	2.4	3.2	3.1	2.0
Sweden	4.1	2.6	3.1	4.3	3.6	3.7
	External diseases					
Kazakhstan	14.9	30.1	30.8	8.0	17.6	17.2
Czech Republic	18.2	24.1	21.9	10.6	12.8	11.8
France	26.9	25.9	21.5	19.7	18.6	13.5
Sweden	24.7	22.3	25.0	15.4	13.5	14.0
	Digestive diseases					
Kazakhstan	2.8	3.8	5.7	2.8	3.9	5.9
Czech Republic	5.7	6.3	8.1	4.1	5.1	7.0
France	6.0	5.6	5.1	6.1	5.4	4.4
Sweden	3.2	3.1	4.1	2.4	2.5	3.7
	Infectious diseases					
Kazakhstan	8.6	11.8	4.7	10.6	8.3	4.2
Czech Republic	0.5	0.4	0.9	0.7	0.5	1.1
France	1.1	1.0	2.1	1.6	1.3	2.0
Sweden	0.9	1.3	1.5	1.3	1.1	1.8
	Other diseases					
Kazakhstan	28.3	14.2	20.8	26.4	20.3	30.3
Czech Republic	15.5	8.5	10.8	22.1	12.8	13.2
France	20.9	19.8	23.2	26.8	23.7	25.7
Sweden	16.0	18.4	17.4	19.3	19.5	18.6

Source: Author's calculations based on data from WHO MDB

Summing up, we can say that YPLL shows the productive life years lost by death from circulatory diseases. In case of Kazakhstan proportion of circulatory diseases from YPLL constantly increases in both sexes in the years 1986-2008. Decline in proportion was observed among the selected European countries throughout the period under observation (Table 21). YPLL show the burden of mortality of cancer before age 75. Contrary to most other diseases, the difference between genders is more limited, because of the high female breast cancer mortality. Among males the highest YPLL, due to cancer mortality are found in the Czech Republic, the lowest YPLL are found in Sweden (Table 19). The differences in YPLL by respiratory diseases between highest and lowest rates are very high, and higher among males. YPLL by digestive diseases in Kazakhstan has the highest values in both sexes among the selected countries, then follows the Czech Republic, next is France, and the lowest rates are found in Sweden. External causes of death are frequent among young people and rare among the elderly. This is testified by the high burden of mortality among people below age 75, especially in Kazakhstan. The highest losses of productive life due to infectious diseases among men can be found in Kazakhstan. The lower figures are found in all the selected European countries: the Czech Republic, France and Sweden. Among women, we can observe the same distribution of YPLL due to infectious diseases: the highest proportion of YPLL is found in Kazakhstan. The lowest figures are found in France, Sweden and the Czech Republic. Other diseases are one of the important causes of death, and play great role in YPLL. Kazakhstan is an absolute leader among the selected countries, the Czech Republic and France have relatively low rates, and Sweden shows the lowest rates of YPLL in comparison with the selected countries in both sexes (Tables 19-20).

According to the analysis observed in this chapter, we conclude that Kazakhstan is quite diverse in its patterns of mortality by causes of death from the selected European countries. In the Czech Republic, France and Sweden the category accounting for the biggest loss of life embraces diseases of the circulatory system, neoplasms and external causes of death, while in Kazakhstan in addition to the above mentioned diseases we can add respiratory, infectious, and group of other diseases which are the significant category among males and females.

High levels of mortality trends are usually due to adverse changes in health, reduced quality of life, social environment and health, as well as constant disregard for the value of human life, both in public and at the individual level. Summing up, mortality is composed of a number of reasons, directly depending on the socio-economic development of the country.

Chapter 8

Mortality trends by major neoplasms

This chapter provides an overview of the dominant cancer sites, their ASMR and trends in the selected European countries and Kazakhstan, quantifying the current burden of cancer and highlighting the major malignant neoplasms from 1986 through 2008.

In the past 30 years the global burden of cancer has more than doubled, with an estimation of over 12 million new cases of cancer diagnosed in 2008, 7 million deaths from neoplasms, and 25 million persons now live with cancer. The global burden is continuing to rise (Boyle and Levin 2008). According to the World Cancer Report 2008, the most frequent types of cancer worldwide (in order of the number of global deaths) are: lung, stomach, colorectal, oesophagus and prostate (among men) and breast, lung, stomach, colorectal and cervical (among women). Overall cancer ASMR peaked in 1988 in the European Union. In the period from 1990-1994 to 2000-2004, overall cancer mortality in the European Union declined by 9% in men and by 8% in women, with larger falls in middle age (La Vecchia et al. 2009).

Cancer is the second only after circulatory diseases as the leading cause of death in Kazakhstan, the Czech Republic and Sweden in 2008, and the leading cause of death in France among males and females at the same year. The age-standardized mortality rates from neoplasms for males in 2008 for Kazakhstan was 225.5 per 100,000 inhabitants, in the Czech Republic, it was 272.8 per 100,000 inhabitants, in France was equal to 240.2 per 100,000 inhabitants, and in Sweden comprises 175.1 per 100,000 inhabitants; for females in 2008 ASMR in Kazakhstan was 122.0 per 100,000 inhabitants, in the Czech Republic was 155.2 per 100,000 inhabitants, France shows 122.6 per 100,000 inhabitants, and Sweden reveals 135.3 per 100,000 inhabitants (see Tables 22-23). We presented recent data for general view of mortality trends by neoplasms, thus they were analysed in the previous chapter and further we will describe mortality intensity from major cancer sites.

Here, we analyze mortality intensity from major neoplasms, in the selected countries for males. According to Table 22, MN of trachea, bronchus and lung among males is the leading cause of death among the selected countries, not including MN of other and unspecified sites. The highest mortality rates throughout the studied period were found out in the Czech Republic, the lowest mortality intensity from this cancer site belongs to Sweden at the same period. All the countries reveal reduction in values throughout the whole period under observation.

Mortality intensity from MN of colon, rectum and anus again was the highest among males of the Czech Republic, and in comparison with other countries values were two times higher during the studied period. Kazakhstan shows increase in 1997 (ASMR 20.7 per 100,000 inhabitants), and in 2008 we observe reduction in values of mortality intensity from this disease (ASMR 18.3 per 100,000 inhabitants), but this level is higher than it was in 1986 (ASMR 16.9 per 100,000 inhabitants). France and Sweden reveal almost the same trends in mortality intensity from colorectal cancer during past two decades (see Table 22).

Stomach cancer was the second leading cause of cancer mortality among males of Kazakhstan. During the whole period we observe the highest level of mortality intensity among males of Kazakhstan, where it was 2-3 times higher than in the selected European countries. The Czech Republic also show higher values than France and Sweden, which both reveal the similar trends in mortality intensity from this cause of death throughout the whole period.

Malignant neoplasm of prostate mostly play significant role among males of the selected European countries. Sweden obtains the highest level of cancer related to prostate. The lowest value was observed among Kazakhstan males. The Czech Republic and France reveal similar values in mortality intensity from MN of prostate during the whole studied period. Comparing values of 2008, we can see that ASMR per 100,000 inhabitants from MN of prostate was equal to 10.1 in Kazakhstan, in the Czech Republic it was 23.6, France shows 20.4, and Sweden reveals 33.4 in the year 2008.

Table 22: Age-standardized mortality rates from major neoplasms (per 100,000 population) in the selected countries, males, selected years

Country	**MALES**					
	ASMR			**Index (%)**		
	1986	**1997**	**2008**	**1997/1986**	**2008/1997**	**2008/1986**
	Neoplasms					
Kazakhstan	310.7	285.7	225.5	92	79	73
Czech Republic	353.4	332.2	272.8	94	82	77
France	322.1	279.4	240.2	87	86	75
Sweden	201.5	200.4	175.1	99	87	87
	Malignant neoplasm of trachea, bronchus and lung					
Kazakhstan	88.3	83.4	60.2	94	72	68
Czech Republic	115.7	94.7	67.6	82	71	58
France	68.1	67.0	60.3	98	90	89
Sweden	35.0	33.3	29.6	95	89	85
	Malignant neoplasm of colon, rectum and anus					
Kazakhstan	16.9	20.7	18.3	122	88	108
Czech Republic	51.3	52.2	40.4	102	77	79
France	29.5	25.6	22.1	87	86	75
Sweden	24.3	21.3	20.4	87	96	84
	Malignant neoplasm of stomach					
Kazakhstan	62.6	45.8	34.8	73	76	56
Czech Republic	30.9	20.7	12.1	67	58	39
France	16.6	10.5	7.5	63	71	45
Sweden	15.0	10.3	6.5	68	63	43

Table 22 : Continued

	Malignant neoplasm of prostate					
Kazakhstan	8.6	8.1	10.1	94	124	117
Czech Republic	24.1	26.4	23.6	110	89	98
France	30.8	26.7	20.4	87	77	66
Sweden	34.8	38.7	33.4	111	86	96
	Malignant neoplasm of lymphatic and haemopoietic tissue					
Kazakhstan	10.5	9.5	7.1	90	75	68
Czech Republic	20.8	19.5	16.2	94	83	78
France	19.5	18.5	17.4	95	94	89
Sweden	17.4	19.5	14.7	112	75	84
	Malignant neoplasm of lip, oral cavity and pharynx					
Kazakhstan	8.4	9.8	8.0	116	82	95
Czech Republic	7.5	9.6	10.1	128	105	135
France	20.7	14.6	9.1	71	63	44
Sweden	3.8	2.9	3.4	77	116	90
	Malignant neoplasm of larynx					
Kazakhstan	8.1	8.8	5.9	109	67	74
Czech Republic	7.1	5.9	3.8	82	64	53
France	13.1	6.8	3.1	52	45	23
Sweden	1.0	0.9	0.7	89	84	75
	Malignant neoplasm of oesophagus					
Kazakhstan	35.5	24.0	16.8	68	70	47
Czech Republic	4.6	7.4	6.4	161	86	138
France	17.8	11.9	8.5	67	72	48
Sweden	4.1	5.0	4.2	122	85	104
	Malignant neoplasm of other and unspecified sites					
Kazakhstan	68.8	73.1	63.2	106	86	92
Czech Republic	89.2	94.1	89.0	106	95	100
France	98.2	91.5	83.5	93	91	85
Sweden	62.4	63.9	57.4	102	90	92
	Other (residual) neoplasms					
Kazakhstan	3.0	2.6	1.1	85	41	35
Czech Republic	2.3	1.6	3.7	69	229	158
France	7.8	6.3	8.2	80	130	104
Sweden	3.8	4.7	4.7	124	99	123

Source: Author's calculations based on data from WHO MDB

Mortality intensity from malignant neoplasm of lymphatic and haemopoietic tissue gives the following picture, Kazakhstan is diverse than the selected European countries, males of Kazakhstan reveal the lowest values during the whole period. While the Czech Republic, France and Sweden show similar trends in age-standardized mortality rates during the same period.

Kazakhstan reveals stable trends in mortality intensity from MN of lip, oral cavity and pharynx during the studied period. The same situation was observed among males of the Czech Republic and Sweden, where values were almost on the same level throughout period under observation, and only France shows continuous decline in age-standardized mortality rates from this cancer site. Mortality intensity from MN of larynx was the lowest among Swedish males. Kazakhstan has the same level of ASMR in the years 1986 (8.1 per 100,000 inhabitants) and in 1997 (8.8 per 100,000 inhabitants), and in 2008 we observe a decline in mortality rates (5.9 per

100,000 inhabitants). The Czech Republic and France reveal steadily reduction throughout the studied period. Mortality trends from MN of oesophagus was the highest during the whole period among Kazakhstan males, and were 2-3 times higher than in the selected European countries. We can single out also France that shows relatively high age-standardized mortality rate from this disease.

MN of other and unspecified sites are also important, thus comprise a huge amount of mortality intensity among males. Kazakhstan, the Czech Republic and Sweden have common features in trends from mortality intensity from this disease. We can observe increase in mortality rates in 1997 in these countries, and in 2008 there was a decline found. In case of France we see positive reduction in mortality intensity from MN of other and unspecified sites.

Mortality intensity due to other (residual) neoplasms should be mentioned too. Throughout the whole period, Kazakhstan shows decline in mortality rates from this disease. In Sweden we observe stable, unchangeable level of mortality intensity, the Czech Republic and France show increase at the end of analysis, but the changes are insignificant (Table 22).

Now we analyze mortality intensity from major neoplasms, in the selected countries for females. According to Table 23, mortality intensity due to MN of trachea, bronchus and lung presents the following picture. Kazakhstan reveals stable trends, and we see positive reduction in 2008, where ASMR was equal to 9.0 per 100,000 inhabitants. The selected European countries show gradual increase in mortality intensity from this cause of death. The recent values for the Czech Republic in 2008 was 19.3 per 100,000 inhabitants. France shows ASMR 15.3 per 100,000 inhabitants, and the highest rate belongs to Sweden and comprises ASMR 23.1 per 100,000 inhabitants at the same year.

The highest mortality rate from MN of colorectal cancer was found in the Czech Republic during the whole period under observation. France reveals steadily reduction in mortality rates from this cause of death during the whole period. Kazakhstan shows increasing values throughout the period, but changes not so significant. Sweden presents almost the same mortality intensity during the studied period.

Mortality intensity due to MN of stomach was highest among females of Kazakhstan during the whole period. Then we observe relatively low mortality rates in the Czech Republic, France and Sweden reveal decline in mortality rates from this cause of death throughout the whole period, and show the lowest levels of mortality intensity as well (Table 23).

Among females in Kazakhstan during 1986-2008 the leading cause of cancer mortality was malignant neoplasm of female breast. We observe gradual increase in mortality rates from this cancer site among females of Kazakhstan. In 1986 ASMR was equal to 14.6 per 100,000 inhabitants, then in 1997 it comprises 20.6 per 100,000 inhabitants, and in 2008 it continue to rise, with ASMR 21.16 per 100,000 inhabitants in 2008. In contrast, the selected European countries reveal only reduction in mortality rates caused by MN of female breast. Time trends in 2008 show that ASMR was 21.2 per 100,000 inhabitants in the Czech Republic, ASMR 24.3 per 100,000 inhabitants was found out in France, and among Swedish females it comprises 20.9 per 100,000 inhabitants at the same year. We see that mortality intensity from this cancer site was almost on the same level among all the selected countries in the given year.

Table 23: Age-standardized mortality rates from major neoplasms (per 100,000 population) in the selected countries, females, selected years

Country	FEMALES					
	ASMR			Index (%)		
	1986	1997	2008	1997/1986	2008/1997	2008/1986
	Neoplasms					
Kazakhstan	154.4	146.8	122.0	95	83	79
Czech Republic	190.9	180.9	155.2	95	86	81
France	140.7	127.6	122.6	91	96	87
Sweden	147.3	144.2	135.3	98	94	92
	Malignant neoplasm of trachea, bronchus and lung					
Kazakhstan	12.6	12.1	9.0	96	74	71
Czech Republic	12.3	16.3	19.3	132	118	156
France	6.6	9.3	15.3	140	164	231
Sweden	12.9	17.9	23.1	139	129	179
	Malignant neoplasm of colon, rectum and anus					
Kazakhstan	12.8	13.6	13.2	107	97	103
Czech Republic	26.8	26.7	18.9	99	71	71
France	17.3	14.7	12.9	85	88	75
Sweden	17.7	15.8	15.3	90	97	87
	Malignant neoplasm of stomach					
Kazakhstan	26.6	19.5	12.3	73	63	46
Czech Republic	15.4	10.6	6.2	68	58	40
France	6.6	4.0	3.0	61	74	45
Sweden	8.3	5.3	3.2	64	61	39
	Malignant neoplasm of breast					
Kazakhstan	14.6	20.6	21.2	141	103	145
Czech Republic	31.1	29.3	21.2	94	72	68
France	28.3	27.6	24.3	97	88	86
Sweden	25.2	22.9	20.9	91	91	83
	Malignant neoplasm of lymphatic and haemopoietic tissue					
Kazakhstan	6.3	5.5	4.9	86	91	78
Czech Republic	12.4	12.7	9.9	103	78	80
France	11.3	11.6	10.1	102	87	89
Sweden	12.6	12.0	9.4	95	79	75
	Malignant neoplasm of lip, oral cavity and pharynx					
Kazakhstan	1.7	2.0	1.9	116	97	112
Czech Republic	1.4	1.5	2.1	106	142	150
France	1.8	1.7	1.6	96	95	91
Sweden	1.3	1.3	1.5	98	118	116
	Malignant neoplasm of larynx					
Kazakhstan	0.8	0.7	0.3	95	44	42
Czech Republic	0.3	0.2	0.3	50	159	80
France	0.5	0.5	0.3	87	60	53
Sweden	0.1	0.1	0.1	64	142	91
	Malignant neoplasm of oesophagus					
Kazakhstan	19.2	12.7	7.1	66	56	37
Czech Republic	0.7	0.9	1.1	118	129	152
France	1.6	1.6	1.4	101	91	92
Sweden	1.1	1.2	1.2	102	106	108

Table 23: Continued

	Malignant neoplasm of other and unspecified sites					
Kazakhstan	58.4	58.9	50.7	101	86	87
Czech Republic	87.9	81.4	74.0	93	91	84
France	61.7	52.5	48.8	85	93	79
Sweden	64.9	63.9	56.7	98	89	87
	Other (residual) neoplasms					
Kazakhstan	1.4	1.2	1.3	81	111	90
Czech Republic	2.5	1.4	2.3	58	165	95
France	5.0	4.2	5.0	84	119	100
Sweden	3.2	3.8	3.7	119	98	116

Source: Author's calculations based on data from WHO MDB

Mortality intensity from MN of lymphatic and haemopoietic tissue was the lowest among females of Kazakhstan, and we observe continuous decline in trends from this cause of death. The selected European countries reveal stable mortality intensity, without significant changes in values during the period under observation. Mortality rates due to MN of lip, oral cavity and pharynx was the lowest among Swedish females during the whole period, but we can not say that mortality intensity was significant high in other countries. Kazakhstan, the Czech Republic and Sweden show similar trends from age-standardized mortality rates throughout the period under observation. Changes in mortality intensity from MN of larynx among females in all the countries under observation was insignificant, due to very low values, which were found out during the studied period (Table 23).

Mortality intensity from MN of oesophagus was the highest among females of Kazakhstan, the same case like was observed among males throughout the whole period. ASMR is not higher than 2.0 per 100,000 inhabitants in the selected European countries. While ASMR from this cause of death was equal to 19.2 per 100,000 inhabitants in 1986 in Kazakhstan, then we observe decline in 1997, where ASMR was 12.7 per 100,000 inhabitants, and further decline in 2008, where ASMR comprise 7.1 per 100,000 inhabitants.

MN of other and unspecified sites comprise a great deal of mortality intensity among the selected countries. However, we observe gradual reduction in values from this cause of death among almost all the selected countries. Only Kazakhstan shows a slight increase in 1997, but in 2008 we observe positive decline in mortality intensity from this diseases.

Mortality intensity was the highest from other (residual) neoplasms in France during the whole period (ASMR 5.0 per 100,000 inhabitants in 2008). The lowest level of mortality intensity was observed in Kazakhstan females (ASMR 1.3 per 100,000 inhabitants in 2008). The Czech Republic and Sweden reveal stable, without big fluctuations trends from age-standardized mortality rates caused by this group of diseases (see Table 23).

Charts showing the intensity of mortality from major neoplasms are available for both sexes separately not only in the Tables 22-23 and also in Annex, where one can find corresponding Figures giving the overview of intensity of mortality from major cancer sites in the selected countries, which also compare data between males and females (see Annex, Figures A8-A9). We have to mention also Table 24 which presents structure of mortality intensity from major neoplasms, in the selected countries during the period of 1986-2008.

Table 24: Structure of mortality intensity from major neoplasms (in %) in the selected countries, males and females, selected years

Country	MALES			FEMALES		
	1986	1997	2008	1986	1997	2008
	Neoplasms					
Kazakhstan	100.0	100.0	100.0	100.0	100.0	100.0
Czech Republic	100.0	100.0	100.0	100.0	100.0	100.0
France	100.0	100.0	100.0	100.0	100.0	100.0
Sweden	100.0	100.0	100.0	100.0	100.0	100.0
	Malignant neoplasm of trachea, bronchus and lung					
Kazakhstan	28.4	29.2	26.7	8.2	8.2	7.4
Czech Republic	32.7	28.5	24.8	6.4	9.0	12.4
France	21.1	24.0	25.1	4.7	7.3	12.5
Sweden	17.4	16.6	16.9	8.8	12.4	17.1
	Malignant neoplasm of colon, rectum and anus					
Kazakhstan	5.4	7.2	8.1	8.3	9.3	10.8
Czech Republic	14.5	15.7	14.8	14.0	14.8	12.2
France	9.2	9.2	9.2	12.3	11.5	10.5
Sweden	12.1	10.6	11.7	12.0	11.0	11.3
	Malignant neoplasm of stomach					
Kazakhstan	20.1	16.0	15.4	17.2	13.3	10.1
Czech Republic	8.7	6.2	4.4	8.1	5.9	4.0
France	5.2	3.8	3.1	4.7	3.1	2.4
Sweden	7.4	5.1	3.7	5.6	3.7	2.4
	Malignant neoplasm of prostate / Malignant neoplasm of breast					
Kazakhstan	2.8	2.8	4.5	9.5	14.0	17.4
Czech Republic	6.8	7.9	8.7	16.3	16.2	13.7
France	9.6	9.6	8.5	20.1	21.6	19.8
Sweden	17.3	19.3	19.1	17.1	15.9	15.4
	Malignant neoplasm of lymphatic and haemopoietic tissue					
Kazakhstan	3.4	3.3	3.1	4.1	3.7	4.0
Czech Republic	5.9	5.9	5.9	6.5	7.0	6.4
France	6.1	6.6	7.2	8.0	9.1	8.2
Sweden	8.6	9.7	8.4	8.6	8.3	6.9
	Malignant neoplasm of lip, oral cavity and pharynx					
Kazakhstan	2.7	3.4	3.5	1.1	1.4	1.6
Czech Republic	2.1	2.9	3.7	0.7	0.8	1.4
France	6.4	5.2	3.8	1.3	1.3	1.3
Sweden	1.9	1.4	1.9	0.9	0.9	1.1
	Malignant neoplasm of larynx					
Kazakhstan	2.6	3.1	2.6	0.5	0.5	0.2
Czech Republic	2.0	1.8	1.4	0.2	0.1	0.2
France	4.1	2.4	1.3	0.4	0.4	0.2
Sweden	0.5	0.4	0.4	0.1	0.1	0.1
	Malignant neoplasm of oesophagus					
Kazakhstan	11.4	8.4	7.5	12.4	8.7	5.8
Czech Republic	1.3	2.2	2.3	0.4	0.5	0.7
France	5.5	4.3	3.5	1.1	1.3	1.1
Sweden	2.0	2.5	2.4	0.7	0.8	0.9

Table 24: Continued

	Malignant neoplasm of other and unspecified sites					
Kazakhstan	22.1	25.6	28.0	37.8	40.1	41.6
Czech Republic	25.2	28.3	32.6	46.0	45.0	47.7
France	30.5	32.7	34.8	43.9	41.1	39.8
Sweden	31.0	31.9	32.8	44.1	44.3	41.9
	Other (residual) neoplasms					
Kazakhstan	1.0	0.9	0.5	0.9	0.8	1.1
Czech Republic	0.7	0.5	1.4	1.3	0.8	1.5
France	2.4	2.3	3.4	3.6	3.3	4.1
Sweden	1.9	2.3	2.7	2.2	2.6	2.7

Source: Author's calculations based on data from WHO MDB

According to Table 24, the highest proportion in the structure of mortality intensity by major neoplasms from MN of trachea, bronchus and lung, MN of colon and rectum, MN of prostate and MN of other and unspecified sites can be noted in all the selected countries among males throughout the whole period under observation. Concerning females the highest proportion in the structure of mortality intensity by major neoplasms from MN of trachea, bronchus and lung, MN of colon and rectum, MN of breast and MN of other and unspecified sites can be seen in all the selected countries throughout the studied period. Moreover in case of Kazakhstan high proportion of MN of stomach and MN of oesophagus appear for males and females during the whole period. The low proportion of MN of lymphatic and haemopoietic tissue, MN of lip, oral cavity and pharynx, MN of larynx and MN of other (residual) neoplasms plays less significant role in the whole structure of mortality intensity from major neoplasms among the selected countries for both sexes.

Here, after making general analysis, we are going to describe relatively detailed analysis. The age-standardized mortality rates by major neoplasms will be discussed in order to investigate the cause-specific mortality levels among the selected countries. A comparative analysis of the ASMR by major neoplasms will be presented for males and females. The selected cancer sites will be the same during the whole analysis.

Malignant neoplasm of trachea, bronchus and lung is the leading cause of cancer deaths in all the selected countries among both men and women. It is well known that smoking is the predominant cause of lung cancer, and it mostly occurs in people who has bad habit to smoke. Tobacco smoking further increases the chance of developing the disease when other environmental risk factors are present. Asbestos, radon, arsenic, nickel can cause lung cancer, even among people who do not smoke (Nawrot et al. 2007). Although, the impact of above mentioned chemicals on the incidence of MN of trachea, bronchus and lung is small in comparison with smoking. According to Figure 17, we can see that in 1986 the Czech Republic (115.66 per 100,000 inhabitants) shows the highest ASMR among males. Then follows Kazakhstan (88.26 per 100,000 inhabitants), the third is France (68.05 per 100,000 inhabitants), and the lowest mortality rate belongs to Sweden (34.98 per 100,000 inhabitants). We can divide these countries into 2 groups, first one comprises the Czech Republic and Kazakhstan, the second one involves France and Sweden, because they show similar trends through the time period 1986-2008. The first group shows the highest ASMR from lung cancer at the end of 1980s, then in 1990s it shows rapid declining and in 2008 Kazakhstan (60.2 per 100,000 inhabitants) has the same mortality rate from lung cancer like France (60.3 per 100,000 inhabitants). The second group (France and Sweden) shows stable, unchangeable trends through the whole time period, for example in 2008 France reveals almost the same mortality rate like in 1986, Sweden shows the identical situation.

Among women, there is an opposite picture. At the beginning of research period the lowest mortality rate for women from lung cancer belongs to France (6.6 per 100,000 inhabitants), while the rest countries have not big differences in mortality rates from the given disease, the Czech Republic (12.3 per 100,000 inhabitants), Kazakhstan (12.6 per 100,000 inhabitants) and Sweden (12.9 per 100,000 inhabitants). From that year the selected European countries show only sharp rise in mortality from lung cancer, in 2008 mortality rates from lung cancer in these countries were almost two times higher than in 1986. The highest ASMR belongs to Sweden (23.1 per 100,000 inhabitants), next is the Czech Republic (19.3 per 100,000 inhabitants), and France (15.3 per 100,000 inhabitants). Concerning Kazakhstan, it shows stable trends, without big fluctuations, and even decreased its mortality rate in 2008 (9.0 per 100,000 inhabitants) (see Figure 17). The mortality of lung cancer in the selected European countries increased significantly among females, reflecting the continuing increase of smoking among younger ages in those countries from the 1980s till nowadays.

Figure 17: Age-standardized mortality rates from malignant neoplasm of trachea, bronchus and lung (per 100,000 population) in the selected countries, males and females, 1986-2008

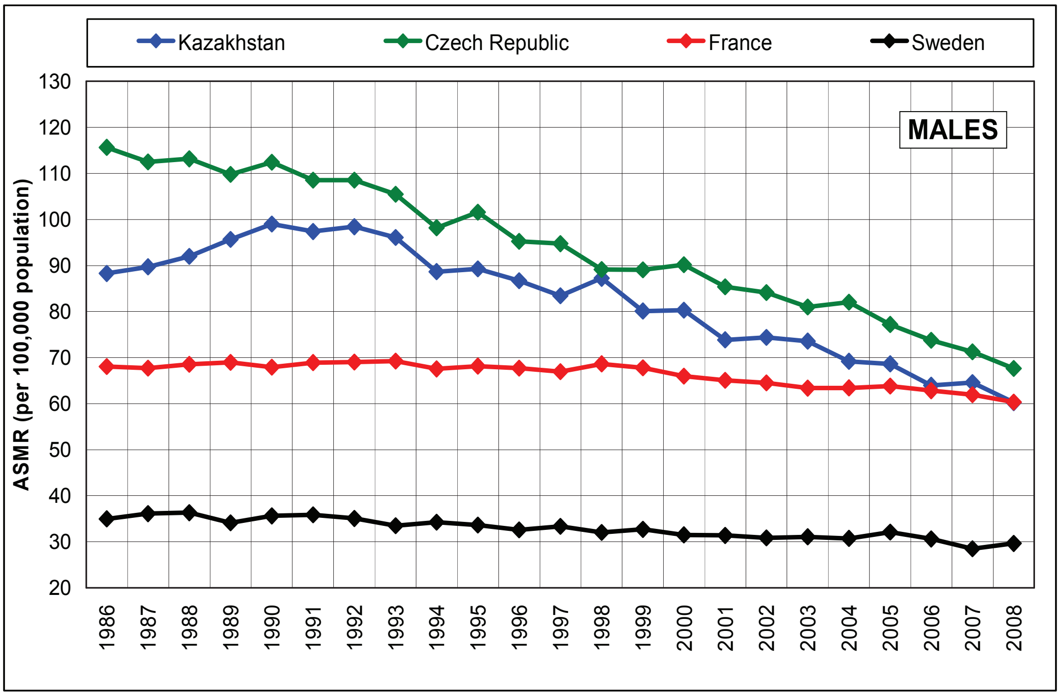
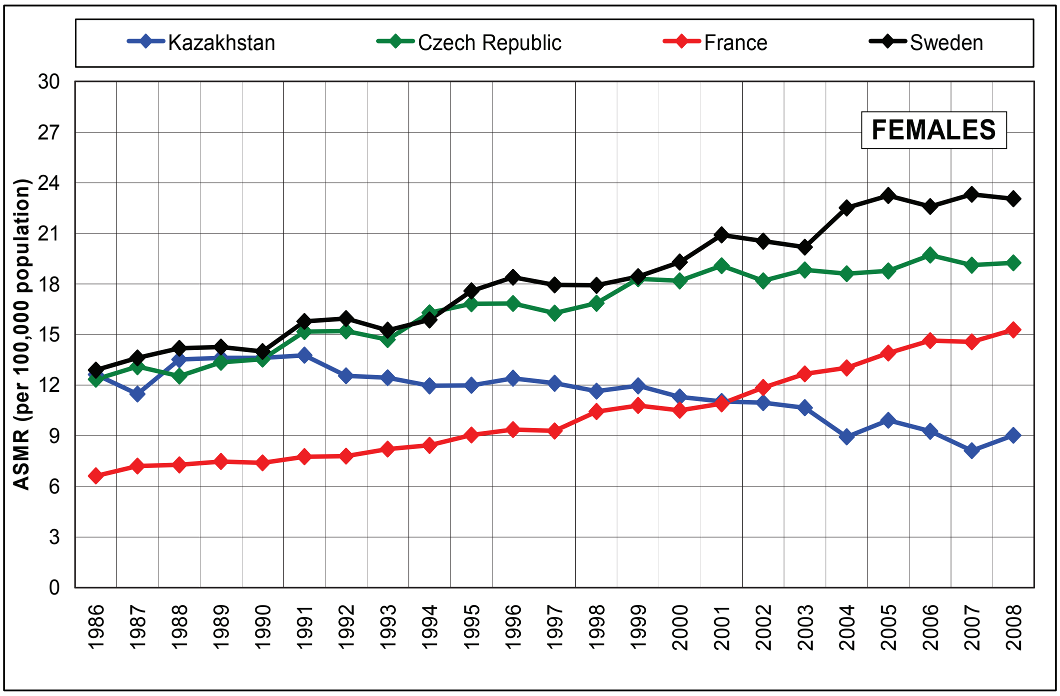


Figure 17: Continued

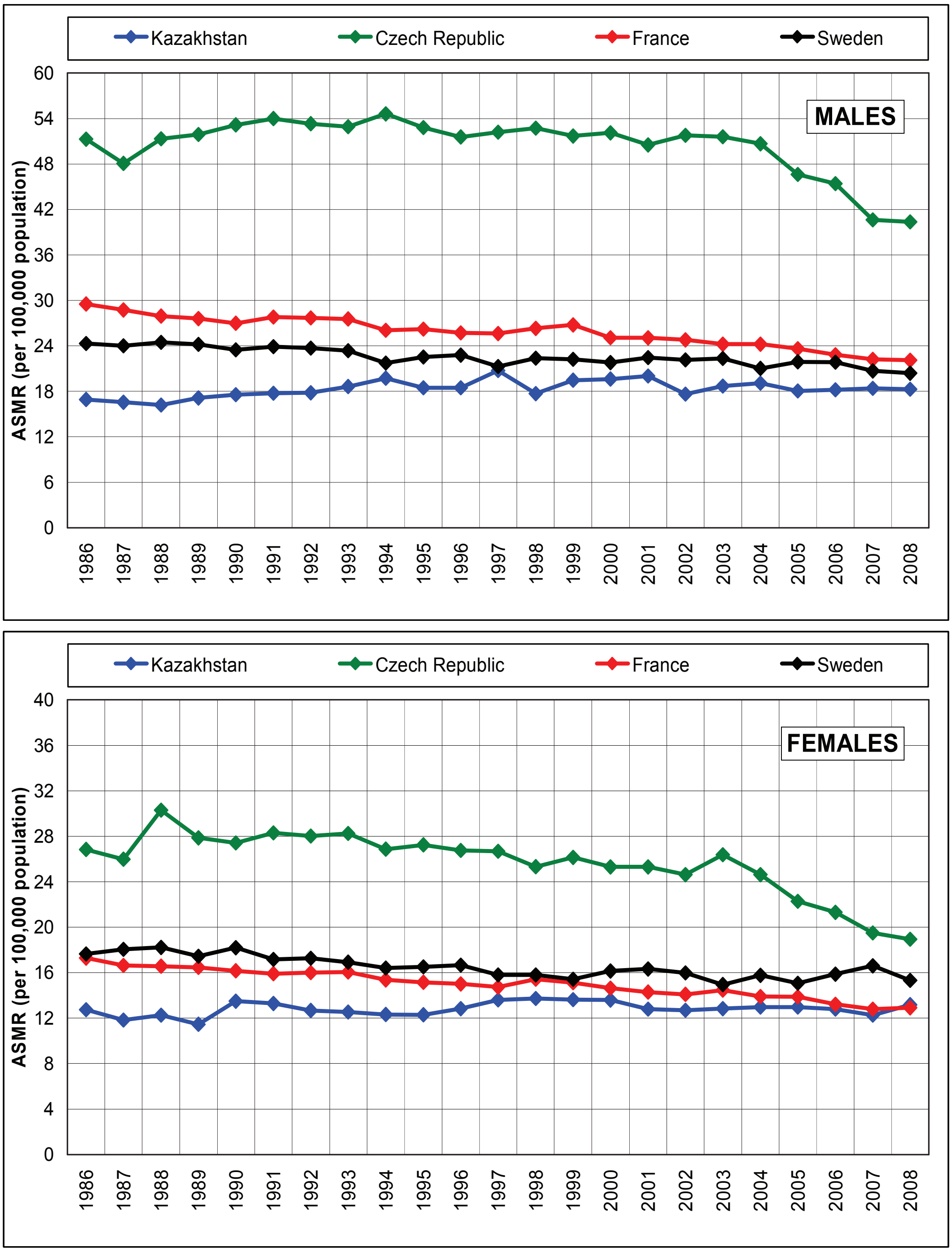


Source: Author's calculations based on data from WHO MDB

Tumors of colorectal cancer often begin in adenomas, noncancerous growths or polyps that may develop on the inner wall of the colon and rectum. The biological factor also plays great role as people get older. Colorectal cancer is used here as a collective term to cover cancers of the colon, rectum and anus. Malignant neoplasm of the colon, rectum and anus is the third most common cause of cancer death among both sexes in Kazakhstan in the year 2008 (Table 24). According to Figure 18 age-standardised mortality rates of colorectal cancer are highest among both sexes of the Czech Republic. National diets poor in fruits and vegetables and rich in meat can be causes to these high rates. The lower rates in France and Sweden can be explained by the healthier Mediterranean diet, which consists of less meat and more vegetables and fishes. But we have to recognize that known dietary and other lifestyle factors can not explain fully the colorectal cancer rates. Kazakhstan reveals the favourable trends among both sexes from the very beginning 1986 through 2008. All the selected countries present stable, without big fluctuations, trends through the time period of 1986-2008. After 2000 the Czech Republic shows decrease in values for both sexes, nevertheless males have significant differences in comparison with the remaining countries in 2008 (ASMR 40.4 per 100.000 inhabitants).

In the case of females, we can say that they nearly approached the ASMR (18.9 per 100,000 inhabitants), which France (12.9 per 100,000 inhabitants), Kazakhstan (13.2 per 100,000 inhabitants) and Sweden (15.3 per 100,000 inhabitants) reveal in the same time period (Figure 18). Malignant neoplasm of colon, rectum and anus can often be prevented through regular screening. Nowadays the cause of MN of colon, rectum and anus is now well known, but some factors can increase the risk of getting such kind of cancer: age (most cases of colorectal cancer occur in people over 50), smoking, inherited conditions.

Figure 18: Age-standardized mortality rates from malignant neoplasm of colon, rectum and anus (per 100,000 population) in the selected countries, males and females, 1986-2008



Source: Author's calculations based on data from WHO MDB

Malignant neoplasm of stomach is the second most common cancer found in Kazakhstan, in both males and females, excluding malignant neoplasm of other and unspecified sites (Table 24). Most cases of stomach cancer began to occur among people, who are over 30 years old, the average age is approximately 70 years (Cancer.net 2012)(see Annex, Figures A11-A14). Men are much more likely to develop this kind of cancer than women, mortality rates in men are double those in women. Despite decline in incidence rates, stomach cancer is still a common tumour-related cause of death. Stomach cancer can be caused by the following factors: diets high in salted or pickled foods, smoking and high alcohol consumption. But mostly eating habits play a major role. Consumption of grilled or smoked foods also seems to promote the development of MN of stomach.

The mortality of stomach cancer declined in all the selected countries, especially significantly in Kazakhstan, comparing the years 1986 and 2008 we can say that ASMR values were halved. ASMR among men in 1986 was (62.6 per 100,000 inhabitants) and in 2008 was (34.8 per 100,000 inhabitants), ASMR among women in 1986 was (26.6 per 100,000 inhabitants) and in 2008 was (12.3 per 100,000 inhabitants). France and Sweden show the lowest mortality rates in both sexes: France males (7.5 per 100,000 inhabitants in 2008), females (3.0 per 100,000 inhabitants in 2008); Sweden males (6.5 per 100,000 inhabitants in 2008), females (3.2 per 100,000 inhabitants in 2008). The Czech Republic is on the second place in both sexes, situated between Kazakhstan and France-Sweden, the gap between the Czech Republic and the selected remaining European countries had diminished significantly since 1986 (Figure 19).

Figure 19: Age-standardized mortality rates from malignant neoplasm of stomach (per 100,000 population) in the selected countries, males and females, 1986-2008

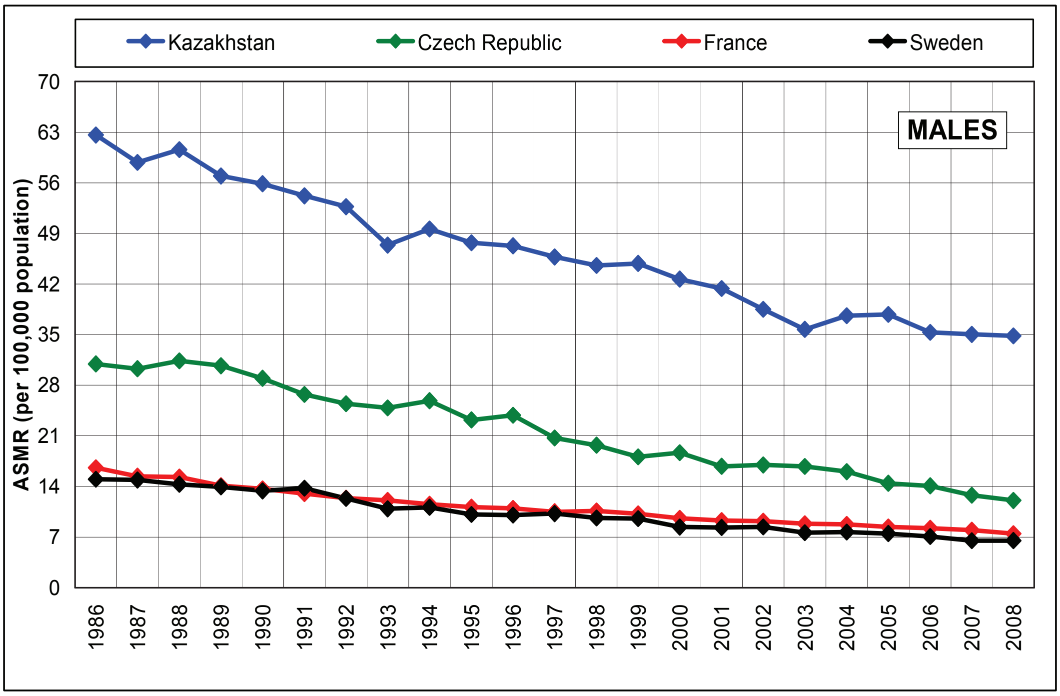
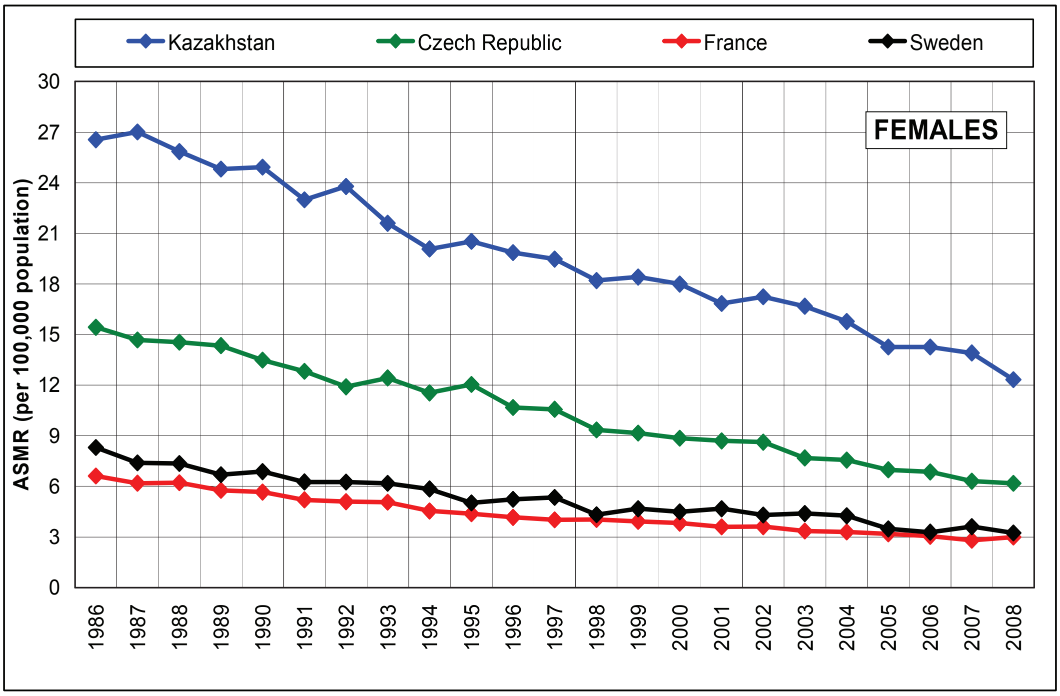


Figure 19: Continued

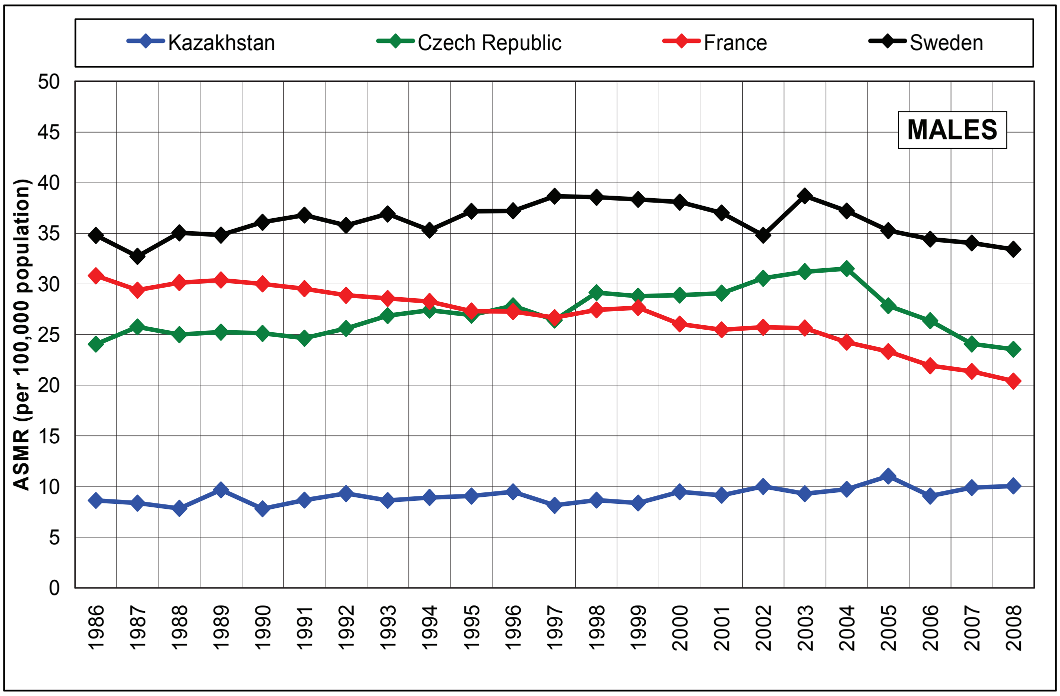


Source: Author's calculations based on data from WHO MDB

Cancer of the prostate is now the 7th most common cancer for men in Kazakhstan, while in the Czech Republic it is the third, in France is the second, and in Sweden is the first (Table 24). The causes of MN of prostate are unknown, although hormonal factors are probably involved, and diet may exert an indirect influence. Lack of exercise and smoking are under discussion as possible risk factors too (Boyle et al. 2003). It is predominantly a disease of old males. In many cases men who has prostate cancer never have symptoms of it, and die due to other causes. That is why treatment of prostate cancer is complicated. The average age at onset is approximately 70 years, which is related roughly to the average age for all cancer sites (Cancer.net 2012). Even now only few people are diagnosed before the age of 50. As the mortality of prostate cancer increases with age, we can state that age is a strong risk factor.

ASMR of prostate cancer is highest among Sweden males, followed by the Czech Republic and France, the lowest rate belongs to Kazakhstan (Figure 20). Trends in prostate cancer in the selected countries followed a simple pattern which can be described in several periods. No significant changes during 1980s, in 1990s we observe the mortality of the disease climbs up in the Czech Republic and Sweden, in France vice versa began to decline. From 2004 in all the selected European countries one can note dropping and stabilization of ASMR from prostate cancer. From 1986 through 2008 Kazakhstan did not show extreme fluctuation in mortality rate. ASMR in 2008 for Kazakhstan is (10.1 per 100,000 inhabitants), the Czech Republic (23.6 per 100,000 inhabitants), France (20.4 per 100,000 inhabitants) and Sweden (33.4 per 100,000 inhabitants). Usually Nordic and Baltic states have higher levels of prostate cancer mortality, but reasons are unknown.

Figure 20: Age-standardized mortality rates from malignant neoplasm of prostate (per 100,000 population) in the selected countries, males, 1986-2008

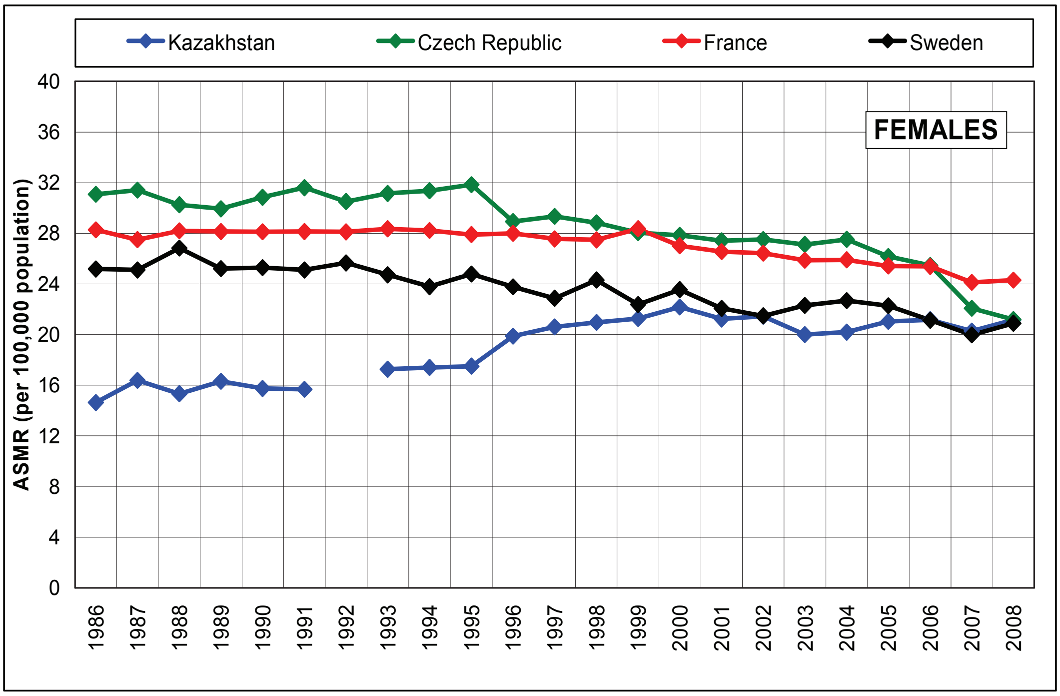


Source: Author's calculations based on data from WHO MDB

Breast cancer is the most common malignant neoplasm that occurs among women than other types of cancer. There is no country with a really low level of such type of cancer in the world. It is the most common female cancer in all the selected countries except Sweden in 2008 (Table 24). Till the end of 2000 breast cancer was the leading cause of death in Sweden, but after that period MN of trachea, bronchus and lung became the leading cause of death among major cancer sites. The risk of developing breast cancer increases with age, most cases usually develop in women after menopause. The scientists can not explain the cause of breast cancer yet. It is likely that multiple risk factors influence the development of the given disease: genetic mutations of breast cancer genes, long time exposure to estrogen, lifestyle factors: obesity, lack of exercise, and alcohol consumption, etc. Breast cancer may occur in men, but it is a very rare disease among males.

Trends of ASMR for female breast cancer varied by country between 1986 and 2008 (see Figure 21). In 1986 Kazakhstan shows the lowest ASMR (14.6 per 100,000 inhabitants) among the selected countries, then we see steadily increase in the mortality rate from breast cancer through the whole period of 1986-2008, while the selected European countries show decline in values, especially the Czech Republic. In 2008, one can observe the following picture, the highest ASMR from breast cancer belongs to France (24.3 per 100,000 inhabitants), and the remaining countries, all together have common results: the Czech Republic (21.2 per 100,000 inhabitants), Kazakhstan (21.2 per 100,000 inhabitants), and the lowest ASMR shows Sweden (20.9 per 100,000 inhabitants) (Figure 21).

Figure 21: Age-standardized mortality rates from malignant neoplasm of breast (per 100,000 population) in the selected countries, females, 1986-2008



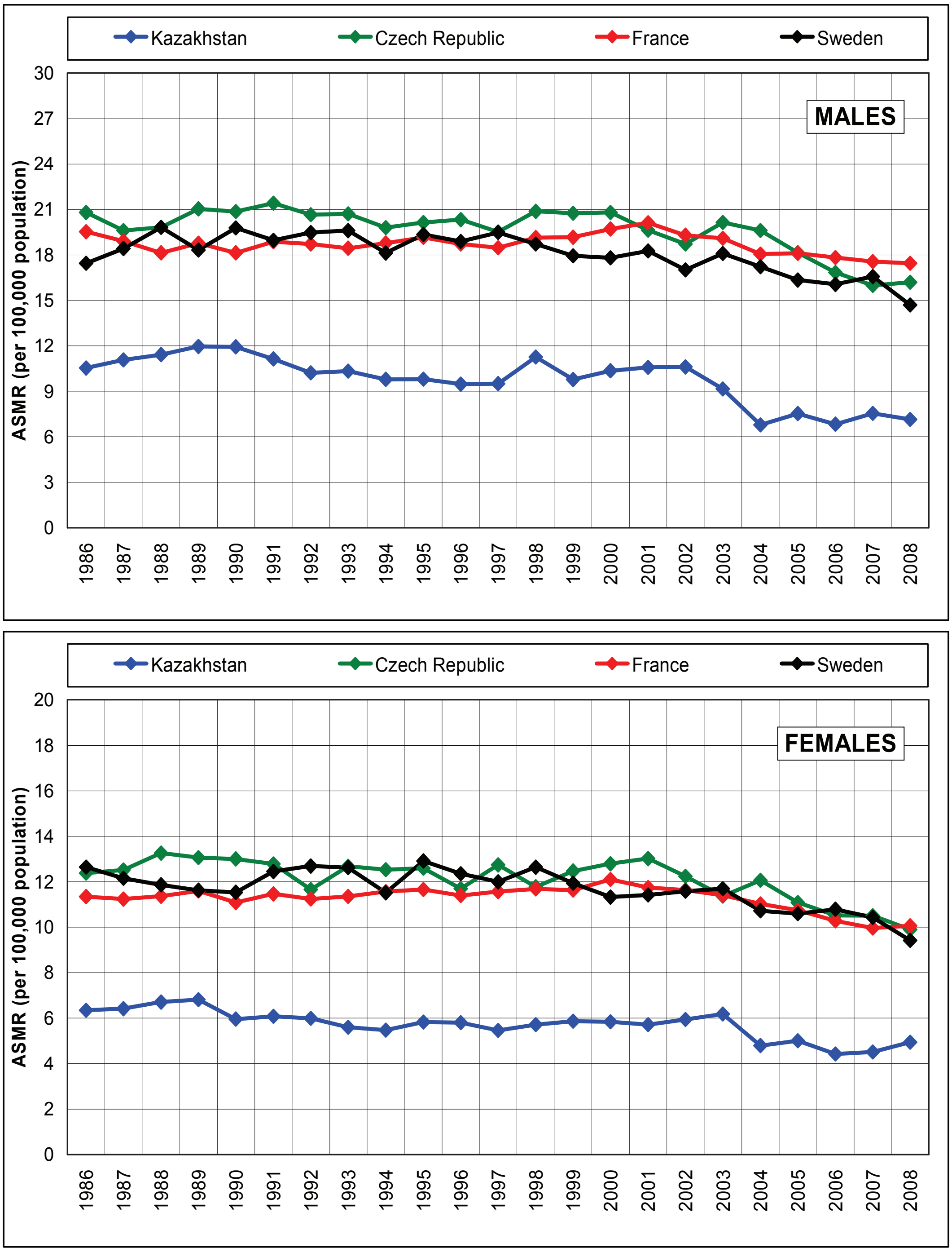
Note: Data for 1992 are not available for Kazakhstan

Source: Author's calculations based on data from WHO MDB

MN of lymphatic and haemopoietic tissue comprises a large group of neoplasms of the immune system. Usually lymphatic cancer arises in lymph node tissue, but sometimes, the tumour develops in the other sites of body, for example, in brain, breast, or bone, stomach. Nowadays it is little known about the causes of the disease, but certain factors can raise the risk of developing the disease: weakened immune system, occupational exposure to chemicals, hepatitis C virus, etc. (Divisi et al. 2006). The average age at onset is very young, a significant proportion of cases already occur in adolescence (see Annex, Figures A11-A14).

Concerning trends in mortality from MN of lymphatic and haemopoietic tissue, one can see from the Figure 22, that all the selected European countries reveal similar ASMR in both sexes during the whole time period of 1986-2008. Kazakhstan shows the favourable age-standardized mortality rates in both sexes throughout the same period, without significant changes. We can say that for 22 years the age-standardized mortality rates decreased in all the selected countries (both sexes), and in 2008 ASMR from lymphatic cancer comprise per 100,000 inhabitants the following results: in Kazakhstan (males 7.1, females 4.9), in the Czech Republic (males 16.2, females 9.9), in France (males 17.4, females 10.1), and in Sweden (males 14.7, females 9.4).

Figure 22: Age-standardized mortality rates from malignant neoplasm of lymphatic and haemopoietic tissue (per 100,000 population) in the selected countries, males and females, 1986-2008



Source: Author's calculations based on data from WHO MDB

Cancers of the lip, oral cavity and pharynx combined are the sixth most common malignancy in males and the seventh most common in females in Kazakhstan in 2008 (Table 24). A major risk factor for the disease is smoking, affecting cancers of the tongue, mouth and pharynx. Long exposure to sunlight can cause lip cancer. Nowadays a very large proportion of this group of neoplasms could be prevented. Men are diagnosed with cancer of the lip, oral cavity and pharynx much more frequently than women. The average age at onset of the disease is 60 years (Cancer.net 2012). The highest structure of mortality among men in the selected countries are in 40-44, 45-49, 50-54, 55-59 age groups (see Annex, Figures A11-A14).

According to Figure 23, the mortality of cancers of the lip, oral cavity and pharynx among males in Kazakhstan shows the similar trends like the Czech Republic. Swedish males reveals the lowest ASMR from the disease, and do not show such a big fluctuation in mortality trends from the given cancer site. The mortality rate from the given cancer declined significantly among males of France, from 1986 through 2008 it diminished two times. Here, we present ASMR for males in 2008: the Czech Republic has 10.1 (per 100,000 inhabitants), then France follows 9.1 (per 100,000 inhabitants), Kazakhstan takes the third position 8.0 (per 100,000 inhabitants) and the last is Sweden with the lowest ASMR 3.4 (per 100,000 inhabitants). Concerning females, one can see that the selected countries from 1986 through 2008 do not have extreme differences in mortality rates from MN of lip, oral cavity and pharynx, except Kazakhstan in 1990s. From the early 1990s Kazakhstan females show steadily increase in values of the disease, with the peak in 1995, then fall and stabilization. ASMR in 2008 for those countries are as follows: Kazakhstan (1.9 per 100,000 inhabitants), the Czech Republic (2.1 per 100,000 inhabitants), France (1.6 per 100,000 inhabitants) and Sweden (1.5 per 100,000 inhabitants).

Figure 23: Age-standardized mortality rates from malignant neoplasm of lip, oral cavity and pharynx (per 100,000 population) in the selected countries, males and females, 1986-2008

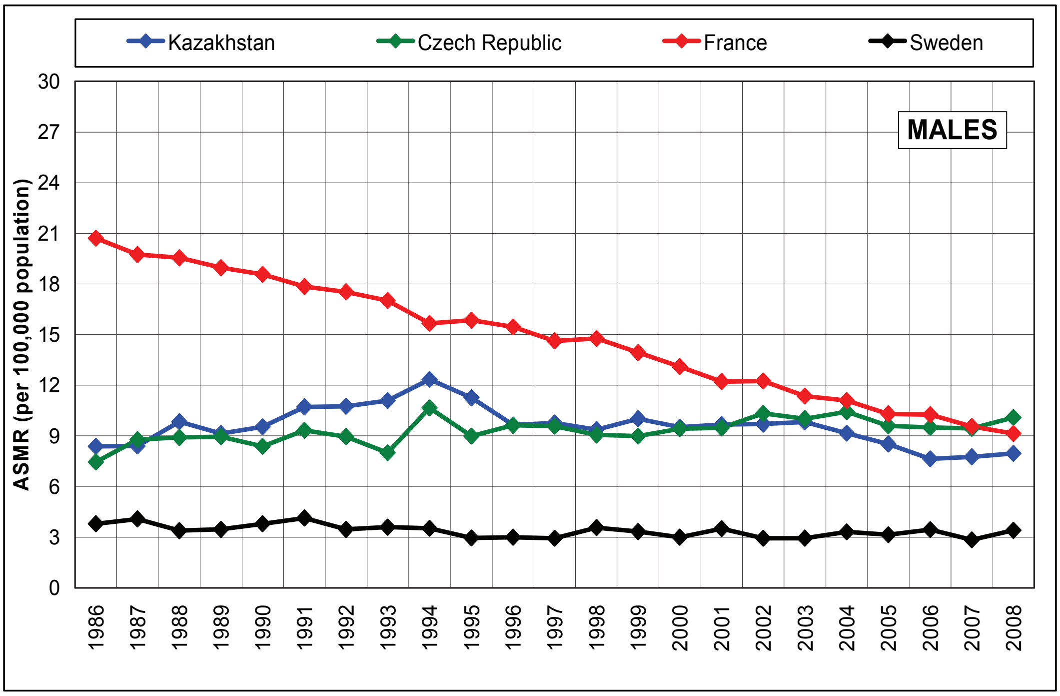
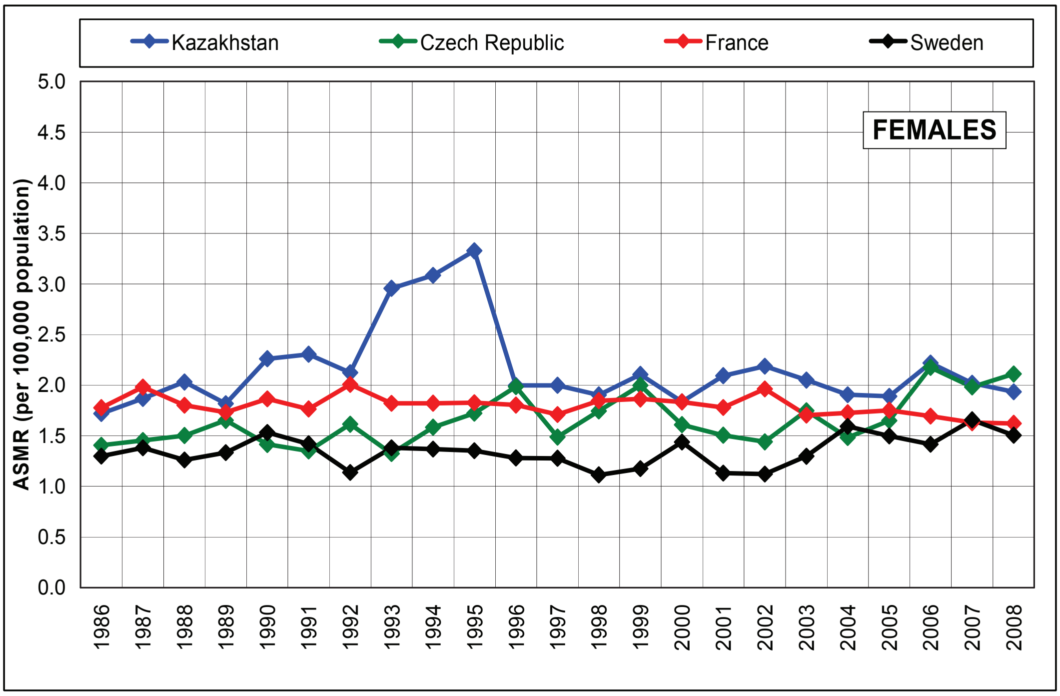


Figure 23: Continued

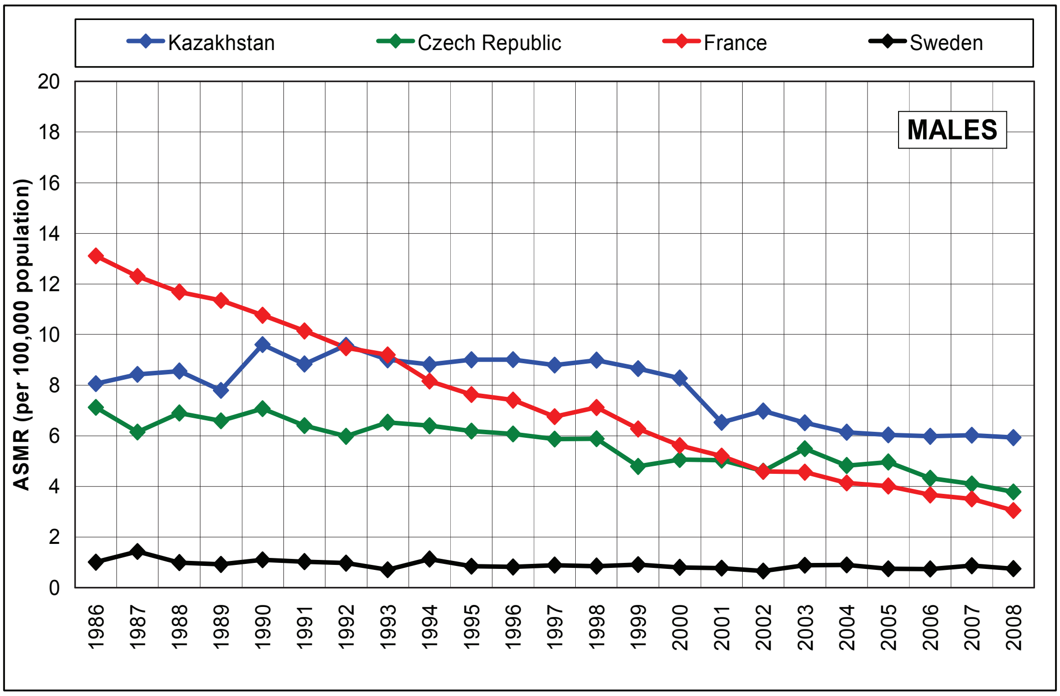


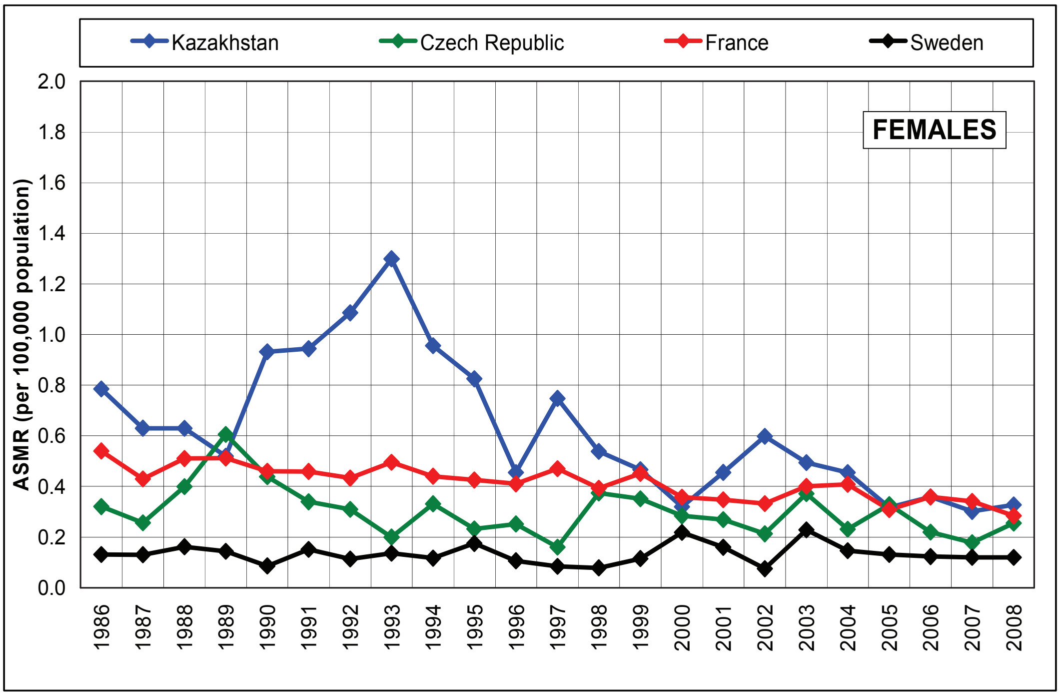
Source: Author's calculations based on data from WHO MDB

Malignant neoplasm of larynx is one of the most common cancers of the head and neck. Men have higher age-standardized mortality rates in comparison with women. According to the results, in the selected countries mortality rate because of the larynx cancer is 10 times higher in males than in females. The disease is also more common over the age of 35 years among males (Annex, Figures A11-A14). We have to mention factors that can raise risk of developing laryngeal cancer: tobacco use (including cigars, cigarettes, pipes and smokeless tobacco), alcohol consumption, especially when associated with tobacco use, occupational exposure to sulfuric acid mist, asbestos, or nickel (Buffler et al. 2004).

The mortality of cancer of the larynx declined steadily in the Czech Republic, France and Kazakhstan among males through the whole period, especially it is clear observed in the Czech Republic. Females show the same trends, except Kazakhstan, where we can see a sharp increase in 1990s. But in 2008 Kazakhstan, France and the Czech Republic females show identical ASMR (average 0.3 per 100,000 inhabitants). Sweden in both sexes presents the lowest ASMR and has almost the same rate in each year through the whole period of 1986-2008 (Figure 24). We suppose that declining trends are most likely due to the steady decrease in the use of tobacco products among adults and older ages.

Figure 24: Age-standardized mortality rates from malignant neoplasm of larynx (per 100,000 population) in the selected countries, males and females, 1986-2008





Source: Author's calculations based on data from WHO MDB

Oesophageal cancer has two main types, the first is squamous cell carcinomas, which occur in the upper part of the oesophagus, and the second is adenocarcinomas, which occur in the lower part of the oesophagus near the stomach. These two types of oesophageal cancer have risk factors and their incidence vary mostly by gender and ethnicity. The developing of oesophageal cancer may be increased by the following factors: tobacco use (smoking and tobacco dipping or chewing), alcohol use, obesity or severe overweight (Cancer.org 2012).

According to Figure 25, one can find that age-standardized mortality rates of malignant neoplasm of oesophagus declined sharply and significantly among males of Kazakhstan and France. The decline was particularly dramatic among Kazakhstan males, who have the highest mortality of oesophageal cancer among the selected countries (ASMR 35.5 per 100,000 inhabitants in 1986, ASMR 16.8 per 100,000 inhabitants in 2008). Among females, the decline was statistically significant for Kazakhstan women only (ASMR 19.2 per 100,000 inhabitants in 1986, ASMR 7.1 per 100,000 inhabitants in 2008). The reason of such a big difference is that Kazakhstan with other countries of Central Asia is falling into the risk region, where residents have predisposition to a specific type of cancer (Ленинградский областной онкологический диспансер 2012). These findings are similar to those registered for stomach cancer, and are consistent with steady decline of tobacco use in the selected countries. Trends of ASMR from this disease among French males are continuously decreasing, the situation among females is stable during the whole period. The Czech Republic and Sweden show modest, without significant fluctuations ASMR from oesophageal cancer in both sexes through the whole time period of 1986-2008.

Figure 25: Age-standardized mortality rates from malignant neoplasm of oesophagus (per 100,000 population) in the selected countries, males and females, 1986-2008

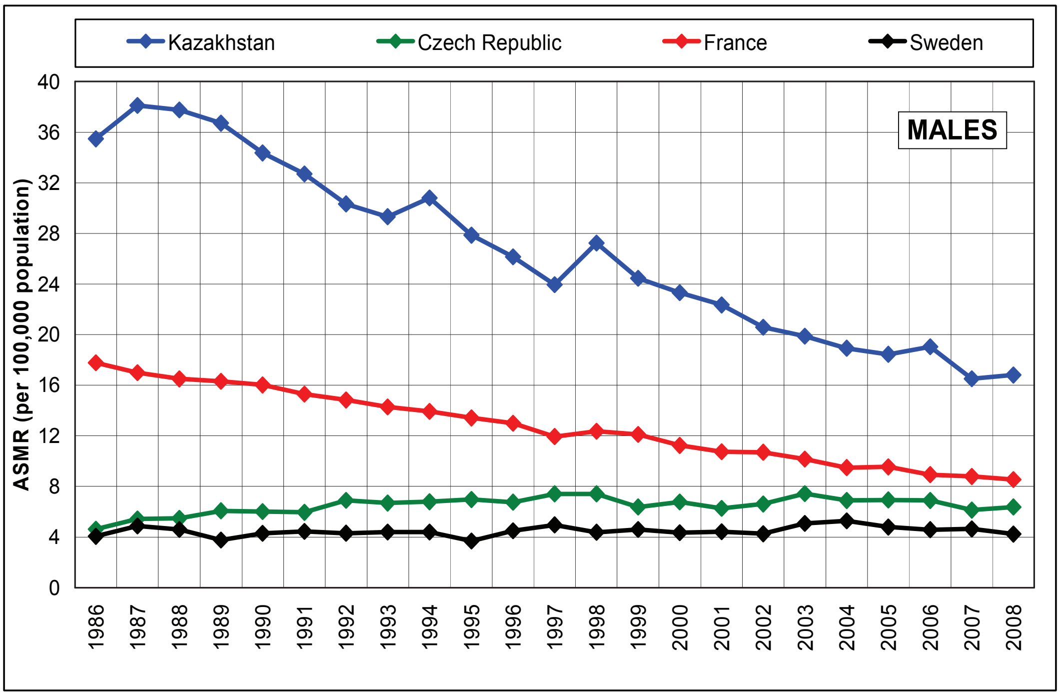
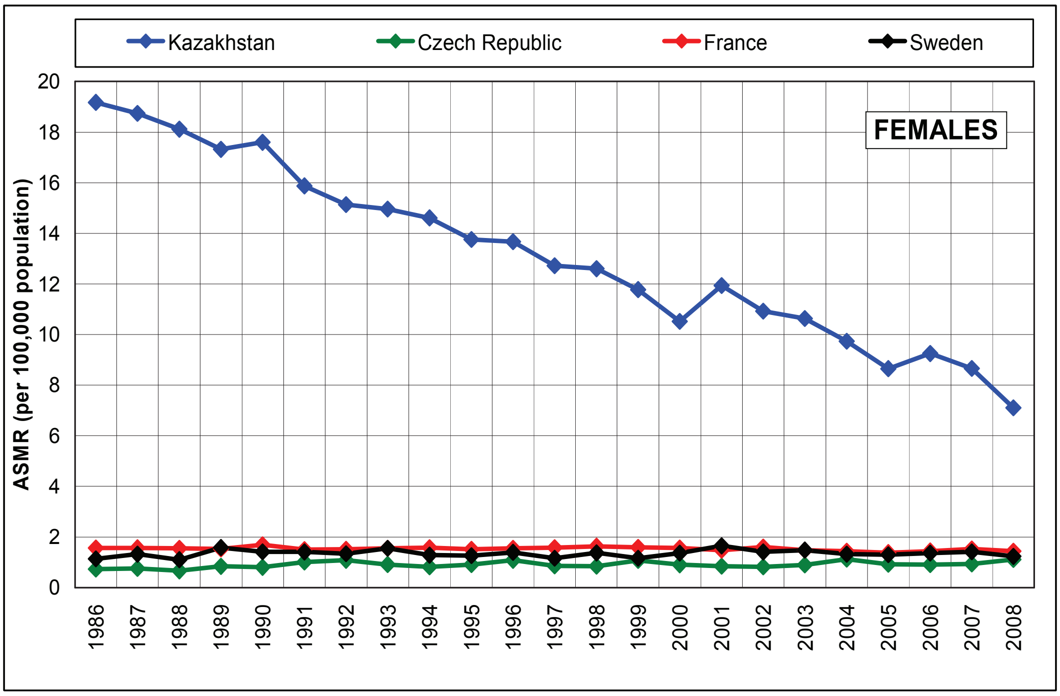


Figure 25: Continued

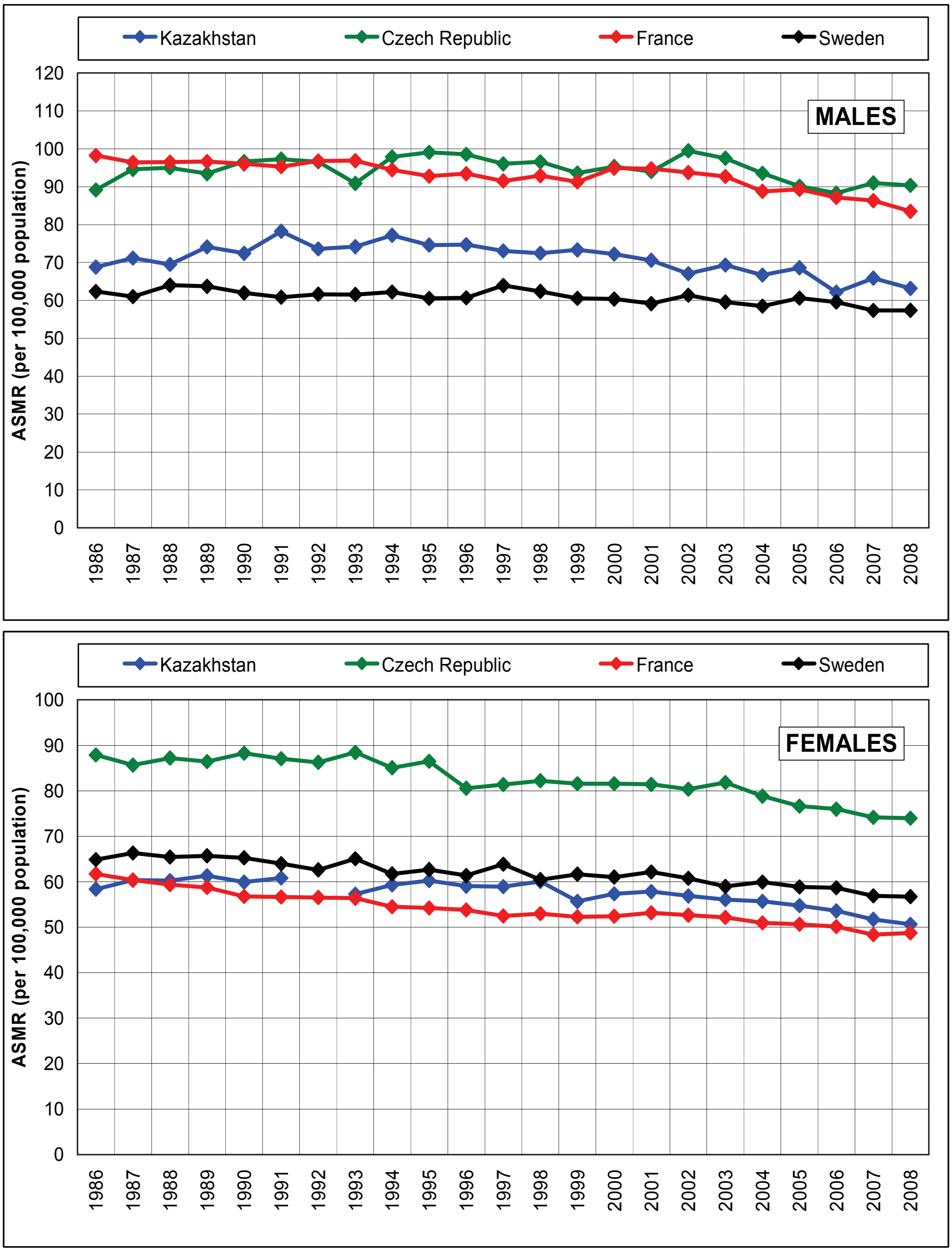


Source: Author's calculations based on data from WHO MDB

Malignant neoplasm of other and unspecified sites in the selected countries comprise different malignant tumors that were not selected as major cancer sites, because of their insignificant number of deaths in comparison with the selected cancer sites. Here, we mention types of those cancers: MN of pancreas, MN of skin, MN of bone, MN of bladder, MN of brain and etc.

The selected countries in both sexes do not show extreme changes in trends throughout the whole research period of 1986-2008. Males of the Czech Republic and France have common trends of mortality intensity, Kazakhstan reveals stable, without fluctuation trends, the favourable ASMR belongs to Sweden. Concerning females, we can see a little bit different picture (Figure 26). Here, France shows the lowest age standardised mortality rate from the diseases 48.8 per 100,000 inhabitants in 2008, the highest ASMR reveals the Czech Republic 74.0 per 100,000 inhabitants, and then follows Sweden 56.7 per 100,000 inhabitants at the same period. In 2008 ASMR from MN of other and unspecified sites in Kazakhstan was equal to 50.7 per 100,000 inhabitants. Kazakhstan is situated between Sweden and France through the whole time period of 1986-2008.

Figure 26: Age-standardized mortality rates from malignant neoplasm of other and unspecified sites (per 100,000 population) in the selected countries, males and females, 1986-2008



Note: Data for 1992 are not available for Kazakhstan

Source: Author's calculations based on data from WHO MDB

Other (residual) neoplasms comprise benign neoplasm, which can be described as follows: „A localized tumor that has a fibrous capsule, limited potential for growth, a regular shape, and cells that are well differentiated" (Farlex, Inc 2012). A benign neoplasm does not invade surrounding tissue or metastasize to distant sites. Some kinds of benign neoplasms are adenoma, fibroma, hemangioma and lipoma. Also called benign tumor. It is very important to have information about rates, patterns, development and features of other neoplasms. It is needed to compare results between different countries and regions, because such elements and hormones that make spreading and development of cancer can represent high proportions of the rates for all combined cancers.

According to Figure 27, we can see significant gaps between age-standardized mortality rates among males in the selected countries. We can also say that males present the similar picture in trends like females, showing only bigger values. For example Sweden in both sexes show increase in ASMR from the disease at the end of 1980s, then drop in the early 1990s, and a sharp growth in 1993. In 2008 the highest age-standardized mortality rates per 100,000 inhabitants belong to France (males 8.2, females 5.0), then Sweden is next (males 4.7, females 3.7), the Czech Republic follows (males 3.7, females 2.3), and the favorable value reveals Kazakhstan (males 1.1, females 1.3).

Figure 27: Age-standardized mortality rates from other (residual) neoplasms (per 100,000 population) in the selected countries, males and females, 1986-2008

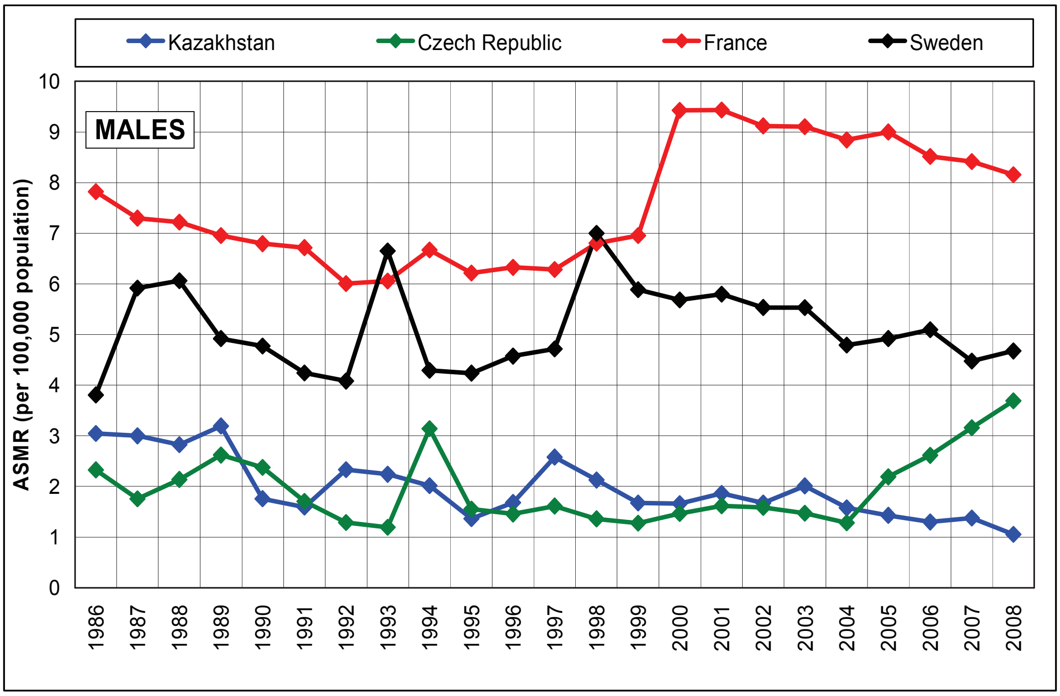
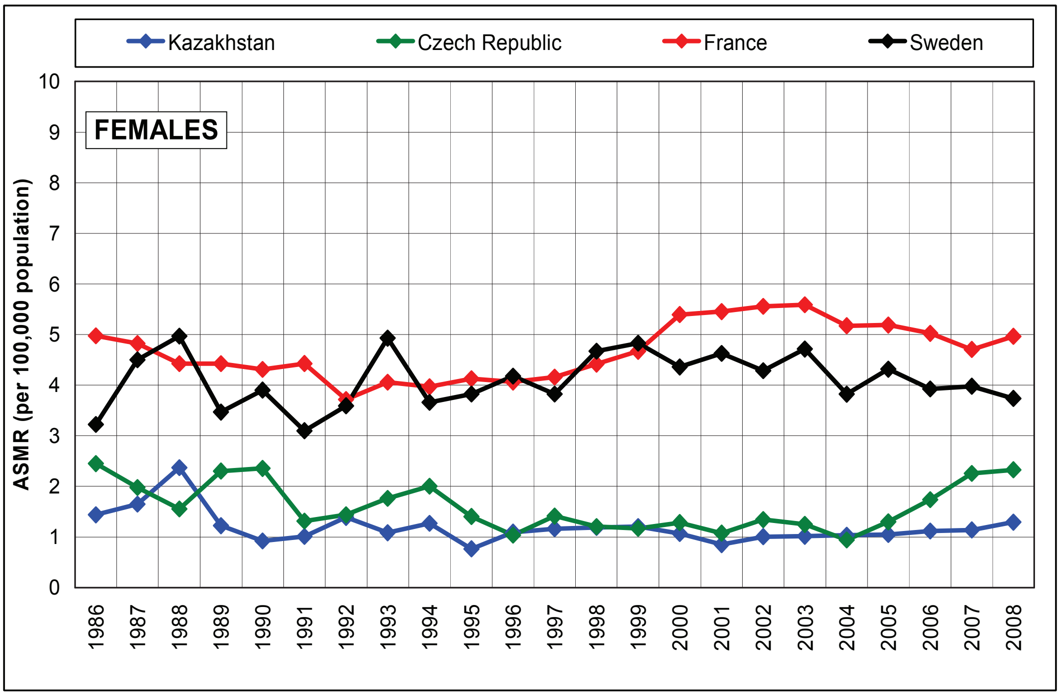


Figure 27: Continued



Source: Author's calculations based on data from WHO MDB

Here we analyse the years of potential life lost, it is a measure that highlights premature, preventable, and unnecessary mortality, which focuses on death before age 75. That's why the figures give an indication of the premature loss of productive life. It is difficult to compare trends from YPLL, for obtained results show less changes during the period of 1986-2008. The year 2008, was selected for analysis of YPLL, because we would like to compare recent changes in the selected countries.

The years of potential life lost by trachea, bronchus and lung cancer show predominantly the loss of productive life by tobacco smoking. According to Figure A10 in Annex, in Kazakhstan, 1,000 men and women lost respectively 4.1 and 0.9 YPLL in 2008, showing the lowest rates among the selected countries. Variance between the selected countries was not large. We should note that for every year lost due to MN of trachea, bronchus and lung, more than one year is lost due to other smoking related cancers. YPLL shows the evolution of the smoking epidemic among young people. One can find that there is a reversal of the gender differential in Sweden. We suppose that it reveals that among males (2.5 YPLL per 1,000 inhabitants) anti-tobacco policies have succeeded relatively. But among females (2.6 YPLL per 1,000 inhabitants) the same policies with respect to smoking behaviour have failed. As malignant neoplasm of colon, rectum and anus is a small cause of death under age 75, the burden of mortality among youth is limited. Malignant neoplasm of female breast causes large losses of life among young women. In Kazakhstan 1,000 women lost 2.7 YPLL. The patterns of YPLL are similar with ASMR ones. Optimal breast cancer treatment can be helpful to reduce breast cancer mortality at premenopausal age. Countries with higher mortality from MN of female breast are France (YPLL 3.5 per 1,000 women), Sweden (YPLL 2.9 per 1,000 women). Next is the Czech Republic with relatively lower breast cancer mortality (YPLL 2.7 per 1,000 women).

We can observe that cross country differences are relatively small. It is due to strong common factors and limited differences in providing sufficient cancer treatment. We can see that YPLL by prostate cancer is limited, because not many people die before age 75 due to prostate cancer. Taking into account the above mentioned caveats, we can see that in Kazakhstan 1,000 men lost 0.3 YPLL, the lowest mortality rate. The highest mortality rate belongs to Sweden YPLL 1.0 per 1,000 men. Then follow the Czech Republic (YPLL 0.8 per 1000 men), and France (YPLL 0.6 per 1,000 men). The results highlight the relatively young age at which males and females with MN of other and unspecified sites die, and very high rates of years of lost productive life. Preventive healthcare of good quality and low access to healthcare remains the most cited factor in the epidemiologic literature.

Summing up, we can say that men in all the considered countries have higher age-standardized mortality rates, compared with women, for all malignant neoplasms (Figures 17-27). During the period under consideration we can observe the decrease in the level of ASMR for both sexes in all the selected countries. The situation in Kazakhstan was worse with cancer of the respiratory system (malignant neoplasm of larynx, MN of trachea, bronchus and lung), digestive system (malignant neoplasm of stomach, MN of oesophagus). The leading cause of death in the class of tumors among men in the selected countries is closely linked with the spread of smoking and ecological problems throughout the whole period. In 2008, the highest male cancer mortality was observed in the Czech Republic (272.8 per 100,000 inhabitants) (Table 22), the picture among women shows that the Czech Republic occupies the leading position among the selected countries (155.2 per 100,000 inhabitants) (Table 23). These rates reflect a relatively high mortality from cancer of colon, rectum and anus and lung among both sexes. Sweden had the lowest male cancer mortality due to low mortality from colorectal, stomach and lung cancer sites in that country. In the case of women, the lowest rates were in France, reflecting its low stomach cancer rates. However, mortality from female lung increased in all the selected European countries (see Figure 17). The high mortality from oesophageal cancer in Kazakhstan for the time period of 1986-2008 was also related to changes in smoking habits and alcohol consumption (Figure 25). Besides, the same period saw marked temporal variations in consumption of alcohol and tobacco, which considered risk factors associated with esophageal cancer. Generally, neoplasms in the selected countries constitute a diverse group of causes of death, dominated by smoking-related cancers that are linked to smoking intensity. However, incidence of cancer varies in countries as some malignant neoplasms were common in the population of the selected European countries (for example prostate, female breast, lymphatic and haemopoietic tissue), while others occur more frequently among the people living in Kazakhstan (for example stomach, oesophagus). Although, these regional differences may be explained by variations in lifestyles, environmental exposure and medical practices, such as screening, which are also likely to be important determinants of cancer risk. Obesity is another lifestyle variable, connected with an increased incidence of cancer. Neoplasms are closely associated with the lifestyles in industrial countries (Klugman and Schieber 1996). Concerning cancer causes and risk factors, we will analyze them in the following chapter.

Chapter 9

Cancer causes and risk factors

The fact that effect of all carcinogenic substances on the human body in our society has long been known, but nonetheless, people continue to deliberately expose themselves to many risk factors. There are a lot of other circumstances, except external factors which can cause harm to human beings, to which people are exposed on their own. Most of scientists suppose that crucial factors are as follows: poor nutrition, disease transmitted through food, and lack of safe access to safe food. Moreover, we can add an overweight and obesity, sedentary and immobile lifestyle, depression and stress that result in serious and progressive damage, which gradually affects the appearance of malignant neoplasms (Ballard-Barbash et al. 2006). Cancer of any location does not occur on healthy soil. It is preceded by lengthy pathological processes caused by one or another etiologic factor. It is generally accepted that cancer sites can cause various adverse of environmental factors. Among the most common reasons in this regard is dust containing radioactive sub-position, chromates, or asbestos (WHO 2005). We have to take into account our everyday life that is one of the fundamental reasons, in which people waste a lot of time for drinking alcohol and smoking cigarettes. In general, a lot of factors can be related to cancer causes, the next chapter will deal with the main harmful effects and factors, which are presented below.

9.1 Tobacco smoking

Smoking is a social problem in majority. One might even say that tobacco smoking is a drug addiction, covering a large number of people. In general using tobacco products or regularly being around tobacco smoke increases the risk of getting cancer. It causes many different cancers: lung, larynx, mouth, oesophagus, stomach, etc. as well as chronic lung diseases, such as bronchitis, and heart disease. Smokeless tobacco (also called oral tobacco, chewing tobacco or snuff) causes oral and oesophageal cancer sites (WHO 2012).

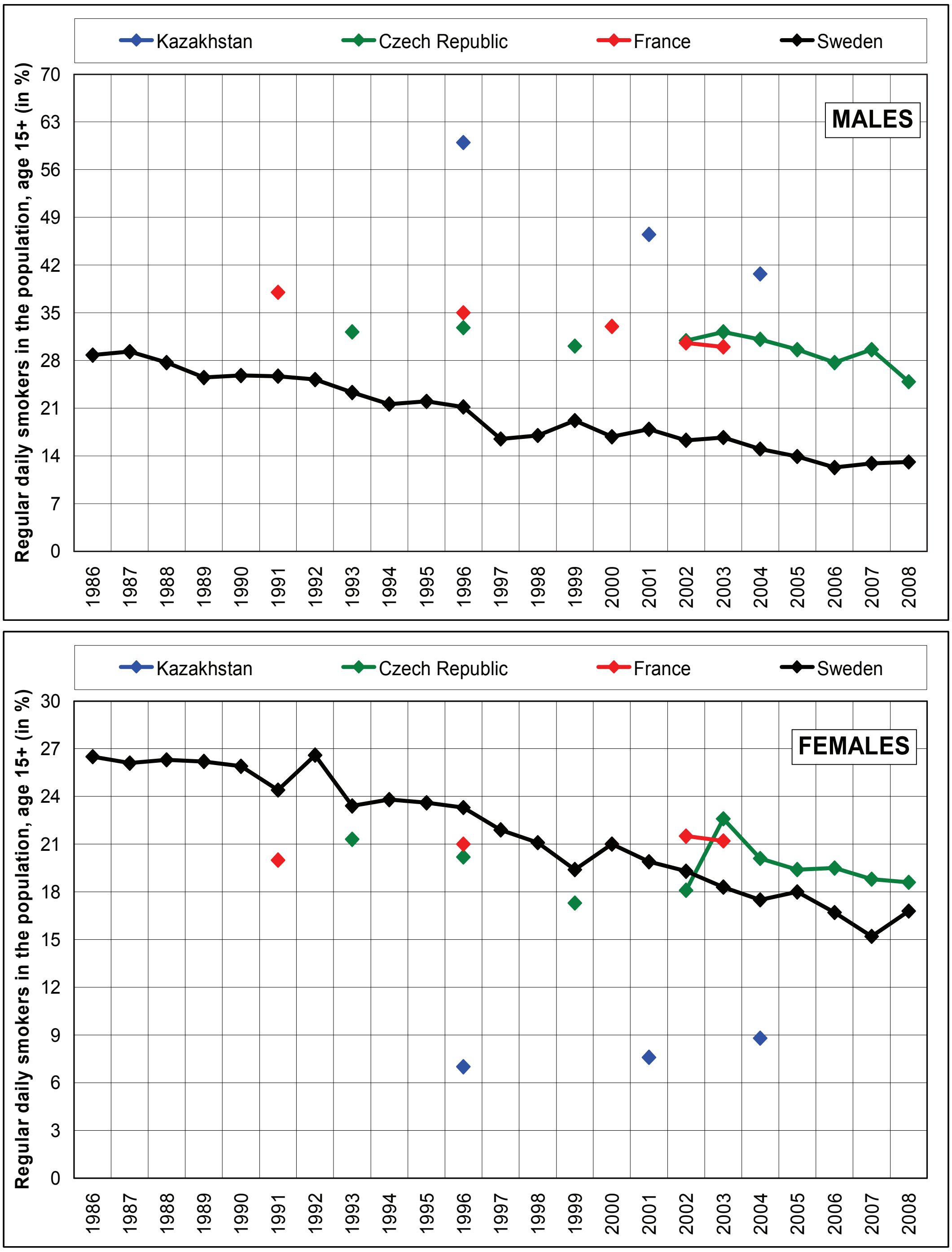
Tobacco smoking is one of the most important and understandable reasons of cancer's appearance as a disease. According to data, made by experts and scientists all over the world, in one cigarette there are more than 4000 elements and 40 elements from them have carcinogenic features (IARC 1986, Buffler et al. 2004, Hecht 2005). The governments of many European countries are taking strong measures to fight tobacco. However, consumption of cigarettes has been rising steadily since manufactured cigarettes were introduced at the beginning of the 20th century. While consumption is decreasing in some countries, more people in worldwide are smoking cigarettes (WHO 2009).

Tobacco use is the most preventable cause of death. Tobacco smoking we are able to understand not only as a great risk for exactly smokers or active smokers, but also for passive smokers, who unfortunately may breath this smoke. Passive smoke is especially harmful to young children. The first and the main method how to stop the prevention of cancer and to decrease the index of premature death is to stop smoking (Boyle et al. 2004).

Here, we present and describe a tendency of cigarette smoking among males and females population of the selected countries. We have to mention the information about data availability. Only Sweden has got full data concerning regular daily smokers in the population for the whole period under observation, unfortunately for the other compared countries data are available only for some years. Figure 28 shows that the prevalence of tobacco smoking was very heterogeneous among the selected countries. The highest level of tobacco smoking among males was observed in Kazakhstan. The Czech Republic and France show similar values, while the lowest value belongs to Sweden. In all these countries the decrease of regular daily smokers in the male population was registered. We have to emphasize that smoking remains the most common and attractive habits among people, causing damage to both sexes and society as a whole. Mortality level due to smoking approximate by women is still rising in many European countries and continues to be a serious problem. According to the same Figure 28, concerning females, it can be noted that smoking habits among women were extraordinary high in Sweden at the beginning of analysis. Since the early 1990s Sweden has shown downward trend in smoking habits and in the mid of 1990s had similar value like the Czech Republic and France. Kazakhstan shows the lowest level among the selected countries and we can see a slight increase in proportion of regularly daily smokers in 2004.

Smoking impacts women's health in the specific way. In scientific literature there is quite a lot of evidences on the impact of smoking on reproductive function of women. The World Health Organization (2010) states that about 22 % of women in developed countries and 9 % of women in developing countries smoke tobacco. In the WHO European Region in 2010, 21 % of women smoke: more than in any other region in the world, but still significantly less than the 59 % of European men who smoke. In the Newly Independent States (NIS) of the former USSR, for the same time period smoking rates are high among men and appear relatively low among women (for example, 61 % and 3 % in Armenia, 53 % and 24 % in Latvia and 43 % and 9 % in Kazakhstan, respectively). Since the privatization of the tobacco industry in the NIS, however, female smoking prevalence in particular and cigarette consumption as a whole have risen rapidly (WHO 2010).

Figure 28: Regular daily smokers in the population, age 15+ in the selected countries, males and females, 1986-2008



Source: Author's calculations based on data from WHO European Health for All Database

The distribution of tobacco smoking in Europe is particularly anxiety. The one of the largest manufacturers and major exporters of cigarettes in the world are located in countries of the EU. The highest results of indexes of tobacco smoking and dependence on it are in the Eastern Europe and in the Central Europe (Costanza et al. 2006). Table 25 shows number of cigarettes consumed per person, and per year, which can be described as follows: the selected European countries reveal decline in trends of consumption cigarettes, while Kazakhstan shows constantly increasing values. The highest number of cigarettes consumed per person was registered among Kazakh people (1,594) in 1997, also smoking cigarettes was significantly frequent in France (1,554). In the same time period the lowest level of number of cigarettes consumed per person was observed in Sweden (790). Relatively low level of cigarette consumption was observed in the Czech Republic (949), but in comparison with the year 1998 it increased significantly (1,491). Non smokers are usually up to six time less likely to suffer a heart attack in comparison with people who used to smoke cigarettes, and the risk of it can increase mostly due to the number of cigarettes consumed (Cancer.gov 2012). It is an additional information to describe the data presented in Figures 4, where we observe high ASMR of male and female mortality from diseases of the circulatory system in case of Kazakhstan, whose intensity increases during the period under observation.

Table 25: Number of cigarettes consumed per person per year, in the selected countries, 1993-2000

Total number of cigarettes consumed (in million pieces), per year								
Countries	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Kazakhstan	N/A	N/A	13,930	19,421	25,109	21509	19,535	22,210
Czech Republic	17,423	21,117	20,663	16,041	9,779	15346	N/A	N/A
France	109,025	103,243	96,143	93,814	91,069	88739	88,960	76,758
Sweden	9,228	9,765	8,601	9,122	6,990	6,750	7,671	8,006
Number of cigarettes consumed per person, per year								
Countries	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Kazakhstan	N/A	N/A	842	1,220	1,594	1,427	1,309	1,494
Czech Republic	1,686	2,043	2,000	1,555	949	1,491	N/A	N/A
France	1,891	1,783	1,654	1,607	1,554	1,508	1,517	1,303
Sweden	1,058	1,112	974	1,032	790	763	866	902

Note: N/A = not available
Source: Author's calculations based on data from WHO European Health for All Database

According to the researches, which were held in Japan, North America and Europe, 87-91 % among men and 57-86 % among women of lung cancer diseases are associated with cigarette smoking. To continue with statistics we need to stress that from 43 % to 60 % among humans of cancer diseases are associated with the influence of tobacco, either in combination with alcohol or without it (Boyle et al. 2003). ASMR from MN of trachea, bronchus and lung can be used as an indicator of the number of smokers who die prematurely, and also as a marker of past trends in population exposure to tobacco smoke. Age-standardized mortality rate in 2008 was 60.2 per 100,000 population among men and 9.0 per 100,000 among women in Kazakhstan (Tables 22-23). These rates show a clear difference in cancer risk between men and women. Lung cancer is the leading cause of cancer death among men in Kazakhstan, the Czech Republic and France, and among women in Sweden, the above mentioned countries among men show higher values in percentage of regular daily smokers (Figure 28). Smoking still involves almost all the segments of the population, particularly women and the youth, e.g. Swedish females reveal the highest value of smokers till 2000, and still have one of the highest rates among the selected countries.

Cigarette smoking causes many types of cancer. Smoking is one of the main risk factors of MN of lip, oral cavity and pharynx and also MN of larynx. French males show the similar trends in ASMR from MN of lip, oral cavity and pharynx (see Figures 23) and in ASMR from MN of larynx (Figure 24), we suppose that it can be due to the reduction of smokers (see Figure 28), the same suggestion can be said about Swedish males.

Based on the above analysis, it can be concluded that high prevalence of tobacco smoking among men was observed in Kazakhstan, the Czech Republic and France, while in Sweden smoking was less frequent. It can be emphasized that tobacco consumption of the young women was differentiated across the selected countries, in contrast to Kazakhstan, tobacco smoking was the most frequent in the selected European countries.

9.2 Alcohol

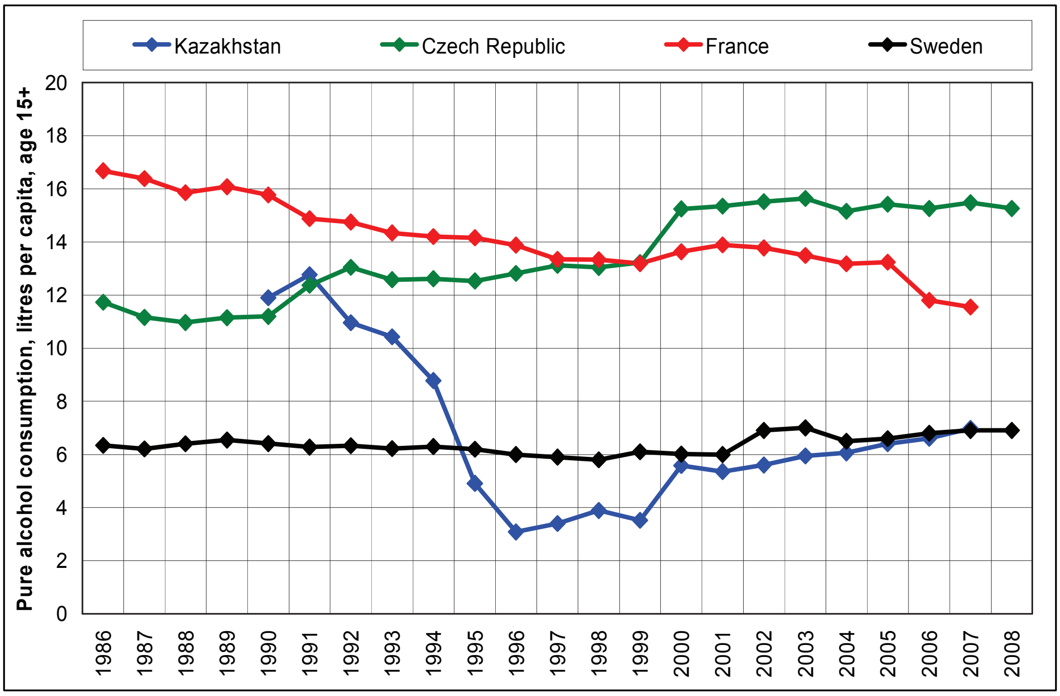
In the etiology of cancer the alcohol consumption also plays a significant role. Scientists have not established a limit of alcohol drinking (the safe level of alcohol consumption). But there is evidence that people who use alcohol every day are more prone to cancer than people who only occasionally use alcohol. For example, men who consumed two or more servings of alcohol per day have an increased risk of developing cancer of the esophagus, mouth or throat. For women it is enough just one alcoholic drink per day to join a high-risk group. Women who drink alcohol are more prone to getting diseases such as liver cancer, breast cancer and colon cancer. (Pöschl and Seitz 2004; Boyle et al. 2003). In addition to the above mentioned reasons, alcohol is also a major risk factor for other causes of death. These include injuries (e.g. injured during leisure activities, traffic, occupational), it is one the leading cause of death among young people in the EU (Petridou et al. 2007).

Alcohol use is a risk ractor for many cancer types including cancer of the oral cavity, pharynx, larynx, oesophagus, liver, colon and rectum, and breast. Risk of cancer increases with the amount of alcohol consumed. The risk from heavy drinking for several cancer sites (e.g. oral cavity, larynx and oesophagus) substantially increases, if the person is also a heavy smoker. Even if a person does not smoke and only drinks, alcohol consumption increases the risk of cancer of the respiratory tract and upper digestive tract. When a person smokes and drinks, the risk of cancer increases exponentially (Boyle et al. 2003). However, attributable fractions vary between men and women for certain types of alcohol related cancer, mainly because of differences in average levels of consumption.

The WHO European Region, compared with the world or with other region WHO has the highest alcohol consumption per capita in 2006. This rate is two times higher than the world average. Drinking alcohol is the third most important risk factor that leads to many diseases in all age groups in the region. In the first and second risk factors leading to death are high blood pressure and smoking. The rising mortality among young people associated with excessive alcohol consumption (WHO 2006).

According to Figure 29 we can say that pure alcohol consumption was significantly different across the selected countries in studied time period. Kazakhstan reveals a sharp declining trend in alcohol consumption since the early 1990s till 1996. Then we observe stability in trend until 1999, after that period of time Kazakhstan shows constant increase in trend of alcohol consumption. In 2007, Kazakhstan has the same value of alcohol consumption (7.0 litres per capita) like Sweden (6.9 litres per capita), which during the whole period under observation reveals stable trend, without such a big fluctuation. Throughout the entire period alcohol consumption was observed at a high level in the Czech Republic and France. However, the Czech Republic shows only gradual increase in values since the beginning of analysis, while in France one can observe stable decline in trend of alcohol consumption. In 2007, value of alcohol consumption in the Czech Republic was equal to 15.5 litres per capita, which can be defined as the highest level among the selected countries, in the same time period level at 11.6 litres per capita was found out in France.

Figure 29: Pure alcohol consumption, litres per capita, age 15+ in the selected countries, males and females, 1986-2008



Source: Author's calculations based on data from WHO European Health for All Database

MN of colon, rectum and anus is one of the leading cause of cancer death in the Czech Republic among males and females. High alcohol consumption can contribute to the fact that the Czech Republic shows the highest ASMR from this cancer site in comparison with other selected countries (see Figure 18). MN of stomach among both sexes in Kazakhstan has the highest mortality intensity among the selected countries, from Figure 19 we can see that mortality trend of this cancer type gradually decline among both sexes, which can be associated with decrease in alcohol consumption (see Figure 29) and also with decrease in percentage of regular daily smokers among males during the period under observation (see Figure 28). Alcohol consumption as a risk factor can influence the development of MN of female breast, we suppose that values given in Figure 29 can relate to ASMR in Figure 21, because in both cases the Czech Republic and France show the highest values. In addition, heavy drinking can be one of the causes of MN of oesophagus. In case of Kazakhstan, from Figure 25 we see that age-standardized mortality rates among males and females decline significantly throughout the entire period, and we suppose that it can be due to reduction of alcohol consumption in 1990s.

Reducing exposure of alcohol is easy in concept, but is usually more difficult in practice. In general, reducing alcohol consumption may decrease some of the above mentioned malignant neoplasms. Alcohol is a readily available toxic chemical that can yield pleasurable experience or disastrous effects that can cause enormous suffering, such like getting one of the cancer sites. In conclusion, we can say that people should consume alcohol with caution, and beware of their individual sensitivity.

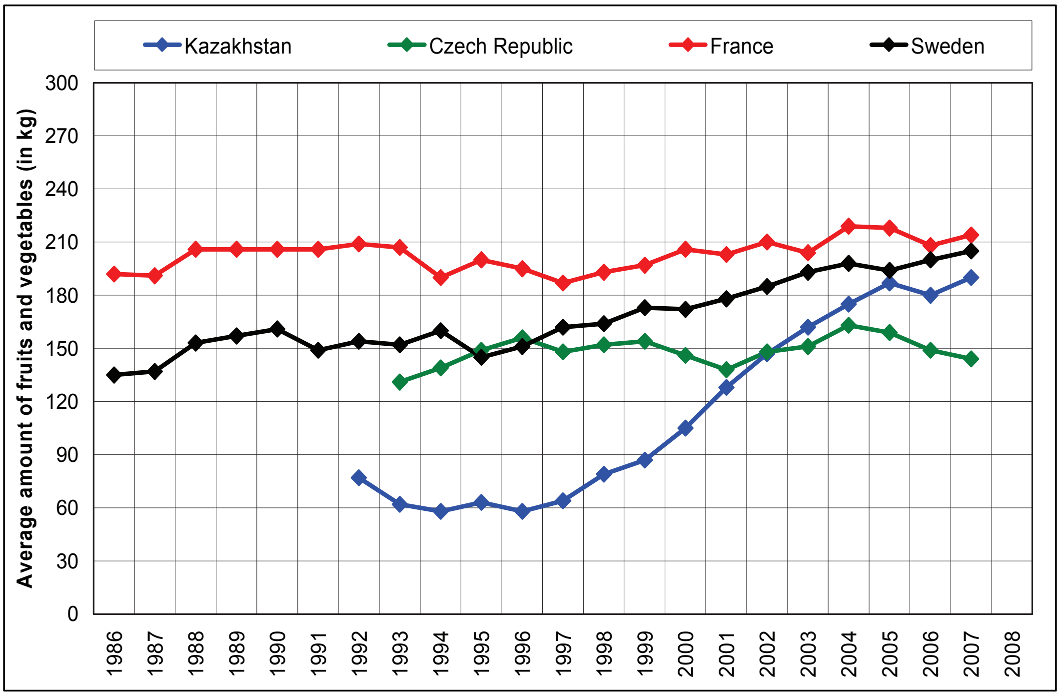
9.3 Diet and nutrition

Scientists have suggested that about one-third (30-40 %) of the total number of cancer deaths may be related to content of the diet. It is not yet confirmed, but the study of this field is developing very recently (Divisi et al. 2006;. Willett 2006).

One of the approaches to cancer control can be related to diet. It has been suggested that a diet rich in fruits and vegetables reduces the risk of various cancers, especially cancers of esophagus, colon and rectum, and stomach. Fruits and vegetables as possible approaches to the prevention of cancer, contain a large number of potential anti-cancer elements (Willett 2006; Boyle et al. 2003). Conversely, excess consumption of red and preserved meat may be associated with an increased risk of colorectal cancer. In addition, healthy eating habits that prevent the development of diet-associated cancers will also lower the risk of cardiovascular disease. As can be seen from Figure 18, ASMR of colorectal cancer are the highest among males and females in the Czech Republic. We suppose that national diets poor in fruits and vegetables and rich in meat can be causes to these high rates (see Figure 30). In southern European countries (e.g. France) the sickness and mortality from many types of cancer (e.g. MN of colon and rectum, MN of stomach) is lower than in other regions of Europe. The reason for this is the Mediterranean food and a diet that includes food rich in fish, olive oil, fruits and vegetables. All of these foods low in animal natural fats. However, to confirm this theory it is important to have more studies (Martin-Moreno 2000; Willett 2006). According to the Figure 30, we can observe that France and Sweden show favorable trends in consumption of average amount of fruits and vegetables throughout the whole period among the selected countries. It can be the explanation of low mortality trends from MN of stomach observed in these countries among males and females during the period under observation (see Figure 19).

According to Figure 19, ASMR from MN of stomach decline steadily among males and females of Kazakhstan throughout the period under observation. Figure 30 presents the trend of average amount of fruits and vegetables consumed per person in (kg), which in case of Kazakhstan rapidly increase in studied time period and even reached the level of Sweden in 2007. We suppose that the given fact can influence the decline in ASMR from MN of stomach. Moreover, we can add that decreasing trends in ASMR from MN of oesophagus among males and females of Kazakhstan can be influenced in the same way.

Figure 30: Average amount of fruits and vegetables (in kg) in the selected countries, males and females, 1986-2008



Source: Author's calculations based on data from WHO European Health for All Database

9.4 Physical activity and obesity

Obesity has now become one of the most common problems in the most European countries. There is a growing number of obese people. This issue has had a serious public health implication. In the WHO European Region from 30 % to 80 % of adults are overweight or obese in 2007. According to WHO statistics at the same time period about 20 % of children and adolescents are overweight. In addition, one third of the children of the total number of youth and adolescents are obese. In recent decades overweight and obesity among children is growing steadily and is now 10 times higher than a generation ago, in the 1970s. Scientists have suggested that in 2010, 150 million adults and 15 million children will be obese (WHO 2007).

Obesity and overweight increases the risk of some types of malignant neoplasms. For example, the disease can occur in the colon, in the breast (in postmenopausal women), in the esophagus, and other organs. This is due to the fact that increases the production of estrogen and insulin, which leads to the negative effect caused by being overweight. Cancer cells may start to grow on the basis of these hormones. If a person regularly engaged in sports, then it reduces the risk of cancer. There are a few evidences that reduced the risk of colon cancer, breast cancer, and prostate. In general this effect is related to the magnitude of body weight and physical activity. Regular exercises, regardless of weight, have a preventive effect for some types of cancer (Boyle et al. 2003; Melzer, Kayser and Pichard 2004).

The list of the discussed topics considered above is not exhaustive. Other lifestyle and environmental factors are known to affect cancer risk include certain sexual and reproductive practices, the use of exogenous estrogens, and certain occupational and chemical exposures (Cancer.gov 2012).

In summary, we selected the causes and factors that appear to impact the risk of major types of cancer and that have been identified as being potentially modifiable. These include tobacco, which has been conclusively linked with a wide range of malignancies. Other potential cancer risk factors include alcohol consumption, diet, physical activity and obesity are indirectly associated with the risk of certain cancers. More research is needed to determine whether these associations are causal and whether avoiding risk behaviors or increasing protective behaviors could actually reduce cancer mortality.

Conclusion

The objective of this study was to give an image of Kazakhstan in the context of selected European countries: (the Czech Republic, France and Sweden) in respect to life expectancy at birth, cause-specific mortality and major neoplasms in the period of 1986-2008. We have found out which types of cancer are the most dangerous ones and also how fast they spread in population over time in the selected countries, hence we have pointed out the trends. The observed trends demonstrate that mortality still has substantial differences among the selected countries in the period of 1986-2008.

After the collapse of the Soviet Union, Kazakhstan experienced economic crisis. The research mortality analyses start from 1986, it can be defined as time of economic uncertainty, and it was compared with data from countries, where the economic situation was considerably more stable. We should mention that the Czech Republic also experienced crisis after dissolution of Czechoslovakia, impacts of the economic crisis in Kazakhstan have been much stronger in comparison with the situation in the Czech Republic (Central Europe Review 1999). All the selected countries experienced different patterns of demographic development along with changes in socio-economic conditions for individuals. The main differences are associated with different levels of development in their economy, financials and social services.

The presented analysis of this research showed the result of the cause-specific mortality patterns in the selected countries. Regarding to the overall mortality levels, which are measured by the life expectancy at birth the selected countries in the period of 1986-2008 showed heterogeneity. The selected European countries reveal positive improvements in values of life expectancy at birth during the given period, except Kazakhstan. From demographic position Kazakhstan was less developed country among the selected countries through the whole time period. In 1986, the lowest expectation of life was less than 64 years for males and less than 73 years for females. Since its independence, only decline in values of life expectancy was observed in Kazakhstan mortality levels (less than 62 years for men and less than 72 years for women in 2008). The highest life expectancy at birth was found in Sweden where for males it was more than 74 years and more than 80 years for females in 1986. By the end of the study period (2008) the expectation of life in Sweden increased approximately by 5 years for men and 3 years for women. The intermediate level of average life span was noted in the Czech

Republic. A large gender gap in life expectancy was observed in Kazakhstan and the shortest one in Sweden.

As regards the mortality trends, the period of 1990s of the last century was important for Kazakhstan. After twenty years of stagnation in the life expectancy at birth, it can be seen a significant deterioration in the health status. This was due primarily environmental pollution, generally unhealthy lifestyle and the associated poor eating habits, increased alcohol and tobacco products (Becker and Urzhumova 2005). A very backward compared to the selected European countries was also the level of health care. Until the 1990s, there have been improving mortality rates and life expectancy at birth in Kazakhstan. In Northern and Western Europe, i.e. Sweden and France, there was contrast to the improvement in mortality rates. Except this, the results of the analysis show very clearly the influence of different political, economic and social development to the level and intensity of mortality.

Regarding to the highest cause-specific mortality levels among the selected countries we can single out Kazakhstan. The most frequent diseases among males and females of Kazakhstan were circulatory diseases, neoplasms and external causes. In the beginning of study period (1986) the level of CVD diseases in Kazakhstan was substantially higher in comparison with the selected European countries. Moreover the level of cardiovascular diseases among both sexes in Kazakhstan extended extremely after increase till 1997 we registered decrease in 2008. Mortality in this group of diseases was still higher at the end of the period under observation comparing to the year 1986. While many European countries have made significant progress in the fight against circulatory diseases, malignant neoplasms remain a serious problem. France can be presented as an example, in 2008 the leading cause of death among males and females was neoplasms. Circulatory diseases were the second cause of death after neoplasms.

The cause-specific mortality levels in the selected European countries after twenty two years time period mostly declined. However, ASMR from infectious diseases and from other diseases increased among both sexes in 2008 in Sweden. The largest decline was in males' mortality level from circulatory diseases, where ASMR from this cause of death approximately declined by half. In general, the cause-specific mortality levels in the selected European countries notably decreased in comparison with Kazakhstan.

Based on the results of cross country analysis of mortality from selected neoplasms in Kazakhstan, the Czech Republic, France and Sweden it can be said, that men in all the considered countries have higher age-standardized mortality rates, compared with women, for all malignant neoplasms. We can observe the decrease in the level of ASMR for both sexes in all the selected countries during the period under consideration. The situation in Kazakhstan was worse with MN of trachea, bronchus and lung, malignant neoplasm of stomach, MN of oesophagus. The leading cause of death in the class of tumors among men in the selected countries is closely linked with the spread of smoking and ecological problems throughout the whole period. In 2008, the highest male cancer mortality was observed in the Czech Republic, the picture among women shows that the Czech Republic occupies the leading position among the selected countries. These rates reflect a relatively high mortality from cancer of colon, rectum and anus and MN of trachea, bronchus and lung among both sexes. Sweden had the lowest male cancer mortality due to low mortality from colorectal, stomach and lung cancer sites in that country. In the case of women, the lowest rates were in France, reflecting its low stomach cancer rates. However, mortality from female lung increased in all the selected European countries. The high mortality from oesophageal cancer in Kazakhstan for the time period of 1986-2008 was also related to changes in smoking habits and alcohol consumption. Besides, the same period Kazakhstan faced marked temporal variations in consumption of alcohol and tobacco, which considered risk factors associated with esophageal cancer.

Generally, neoplasms in the selected countries constitute a diverse group of causes of death, dominated by smoking-related cancers that are linked to smoking intensity. However, incidence of cancer varies in countries as some malignant neoplasms were common in the population of the selected European countries (for example prostate, female breast, lymphatic and haemopoietic tissue), while others occur more frequently among the people living in Kazakhstan (for example stomach, oesophagus).

Age-standardized mortality rates from MN of trachea, bronchus and lung during the given period recorded in Kazakhstan, the Czech Republic, France and Sweden among men reveal downward trends, while the situation among women reveal increase in these countries. The Czech Republic showed up the highest mortality among men during the whole period. Age-standardized mortality rates among men in France are rather closer to the level of Kazakhstan and the Czech Republic, while in Sweden traditionally ASMR reaches lowest values. The mortality level among women can be seen on one side of a steep upward trend and a significantly higher intensity in case of the Czech Republic and Sweden. On the other hand, France reveals significantly lower intensity and a slightly increasing value while Kazakhstan shows decreasing trend. The highest female mortality from MN of trachea, bronchus and lung throughout the period was observed in Sweden.

The favorable development related to mortality in men is due to partially reducing smoking, according to Figure 28 we can see that percentage of regularly daily smokers in the population of Kazakhstan decreases, i.e. in 1996 it was 60 %, in 2001 (46.5 %), and in 2004 (40.7 %). Reduction of mortality of women in Kazakhstan is much more difficult to explain, as it generally leads to increasing the proportion of women smokers, but that is apparent in the occurrence of cancer, not with mortality, in Figure 28 Kazakhstan females show the following values of percentage of regularly daily smokers: in 1996 (7 %), in 2001 (7.6 %) and (8.8 %) in 2004.

In the period from 1986 to 2008, development of mortality among males and females from the MN of colon and rectum within country units observed similar trends. Across the selected countries we registered a slightly downward trend, with the exception of Kazakhstan, where age-standardized mortality rate at the end of the period in both sexes slightly increased. Decrease in ASMR in the Czech Republic, France and Sweden was slower in men than in women. The highest intensity of mortality from this neoplasm during the whole period was observed in the Czech Republic. On the contrary, the situation was most favorable in Kazakhstan and similar trends, with only slightly higher intensities can be observed also in France and Sweden. Mortality level among women in the Czech Republic from MN of colon, rectum and anus in this country closer more to Sweden at the end of analysis. In general the level of mortality from colon and rectum is affected by the quality of lifestyle, diet composition and level of the environment (Divisi et al. 2006).

If we look at development of mortality in France and Sweden, we can experience a downward trend and a significant reduction in mortality from MN of stomach. ASMR compared to other countries were much lower for men and women in Sweden and France. The worst situation was in Kazakhstan and only slightly more favorable in the Czech Republic. The highest ASMR from MN of stomach was in Kazakhstan. Reducing the intensity of mortality from this neoplasm is attributed to an overall improvement in the conservation of fresh foods (Divisi et al. 2006).

MN of prostate among Kazakhstan males shows the most favorable and stable trend throughout the whole period. Sweden, in comparison with other countries, faces much higher intensity of mortality from this cause of death. In the Czech Republic can be seen relatively higher mortality. Very stable trend of mortality was recorded during the 1980s and 1990s in France, and in comparison with the Czech Republic and Sweden was also significantly more favorable. Consequently, by the end of 1990s mortality in the Czech Republic was slightly higher than in France. Deterioration in mortality from this cancer is mainly related to demographic ageing. A frequent cause is diagnosed only in advanced stages of disease when treatment is no longer effective.

ASMR from MN of female breast in Kazakhstan from 1986 was relatively low and stable. Since early 1990s Kazakhstan shows steadily increasing ASMR, in 2008 it has the identical ASMR like the Czech Republic and Sweden. In the case of age-standardized mortality among females, the Czech Republic, France and Sweden have a common downward trend, but with different timing of fall. In Sweden, we observe that throughout the period under observation the level of mortality began to decrease significantly in the early 1990s. There is a pronounced decline in mortality since the middle of 1990s in the Czech Republic and France. ASMR from MN of female breast was the highest in the Czech Republic throughout the whole period. The reduction of mortality is due to some extent influence, the existence of mammographic screening programs which effectiveness is usually seen only after several years of implementation. The effect of organized mammography screening was evident in France and Sweden, where official programs were introduced at the end of 1980s (WHO 2012). Rapidly increasing mortality in Kazakhstan is probably due to late diagnosis and treatment of lower quality.

With regard to mortality from malignant neoplasm of lymphatic and haemopoietic tissue, we can say that the men and women in the selected countries had very similar trends throughout the whole period. Men show higher intensity than women. For the all selected countries we can observe only a slightly decreasing tendency. The most favorable ASMR were in Kazakhstan for both sexes.

The lowest level and a continuous downward trend in mortality from MN of lip, oral cavity and pharynx was found in Sweden in both sexes, until the beginning of 2000s when there was a slight increase in mortality among females. A similar trend can be observed in France and Kazakhstan, where, however, the intensity of mortality increased throughout the period of 1989-1996 among males, and at the same time period among females. Significantly higher age-standardized mortality rates can be seen in France among males. France showed a continuous decrease in mortality intensity since 1986, and had ASMR lower than the Czech Republic in 2008.

Here we describe mortality trends, which were observed from MN of larynx. The favorable trend in mortality from this type of cancer was observed among males and females in Sweden. Kazakhstan and the Czech Republic have common features in mortality trends among males. The value observed in France at the beginning of the analysis was the highest among the selected countries. However, during the period under observation we observe steadily decline in mortality rates from MN of larynx. Among females of Kazakhstan we can notice increasing trends in the 1990s, but during 2000s one can observe stabilization in mortality trends from MN of larynx. The selected European show stable values during the period from this disease.

Age-standardized mortality rates from malignant neoplasm of oesophagus were highest in Kazakhstan throughout the whole period in both sexes. Mortality gradually declined since the beginning of analysis. There was a mortality enlargement in intensity in the period of 1997-1998 among males, and 2000-2001 among females. Slightly lower intensity and a similar trend can be noted in France males. The selected European countries reveal very stable trends, especially among females.

MN of other and unspecified sites reveal us stable, without big fluctuations trends for all the selected countries throughout the period under observation. We should mention also other neoplasms, in all the selected countries males show the same trends like females, the difference only in values during the whole period of analysis.

There are many factors that may contribute to the emergence of cancer sites. It is important to note that malignant neoplasms are related to domestic habits, environmental factors and lifestyle. We mentioned the main factors (tobacco, alcohol, diet, physical activity and obesity) in the chapter related to cancer causes. Moreover, carcinogens as environmental and air pollution play their role in cancer sites emergence and development. All these factors are connected with external environment or occupational hazards. In contrast to the above mentioned factors, tobacco smoking and alcohol consumption remain the most destructive and incredibly widespread habits. Taking into account all risk factors that were mentioned above, it must be emphasized that a behavioral factor plays a key role in the avoidance of negative consequences of carcinogens.

After a phase of analysis of mortality in Kazakhstan and the selected European countries during the past two decades, we have answered to all the questions, that we pointed out in the theoretical part. The analysis presented in this Master thesis has revealed that the current mortality situation in Kazakhstan follows up long term adverse mortality trends of the past two decades. Based on results of age and cause-specific mortality trends in Kazakhstan in comparison with the selected European countries (the Czech Republic, France and Sweden), we can conclude that Kazakhstan underwent mortality crisis, and need to improve its health status. It is difficult to predict the combined effect of mortality development from malignant neoplasms in the selected countries, because the trends of ASMR differ between countries according to age, sex and type of cancer. We hope that our attempt will be helpful in future research works covering the selected countries.

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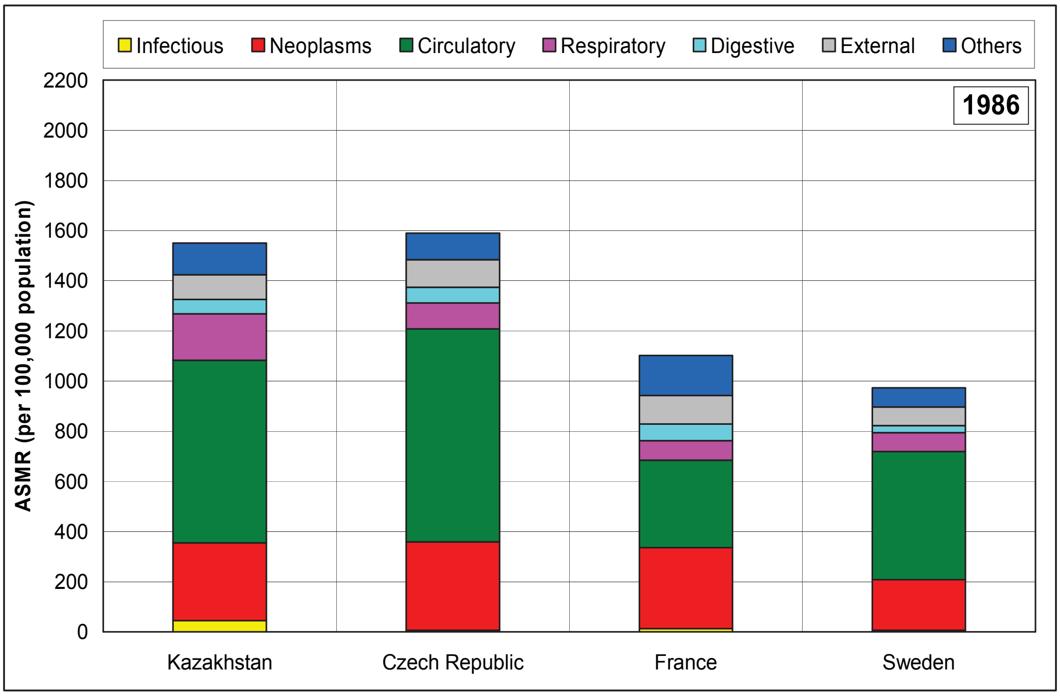
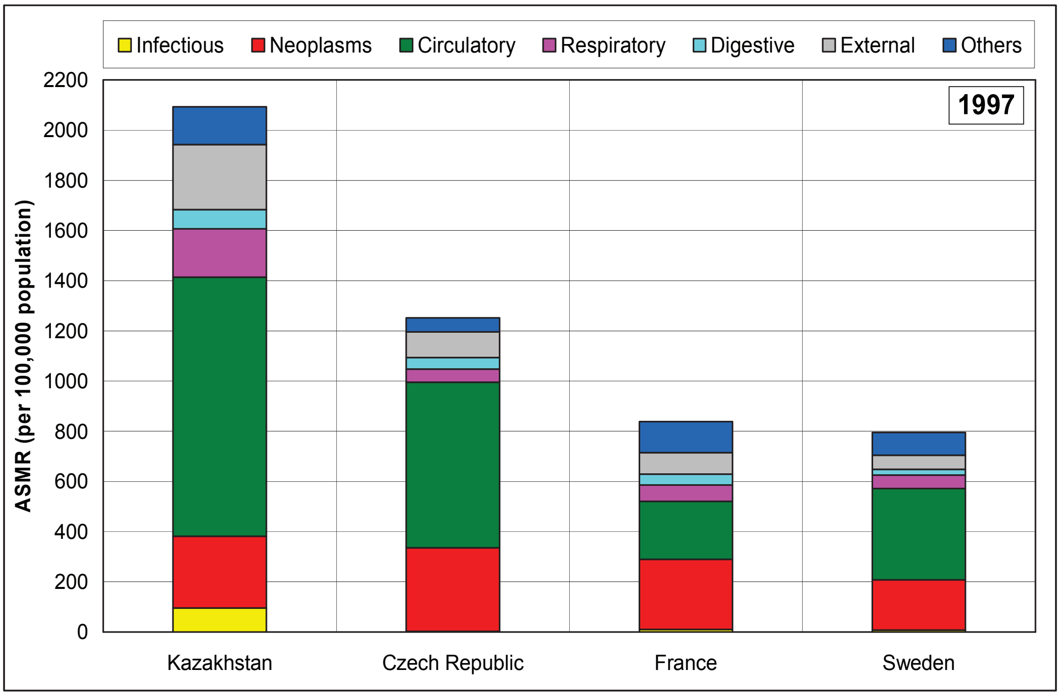
ANNEX

Figure A1: Age-standardized mortality rates from main causes of death (per 100,000 population) in the selected countries, males, selected years





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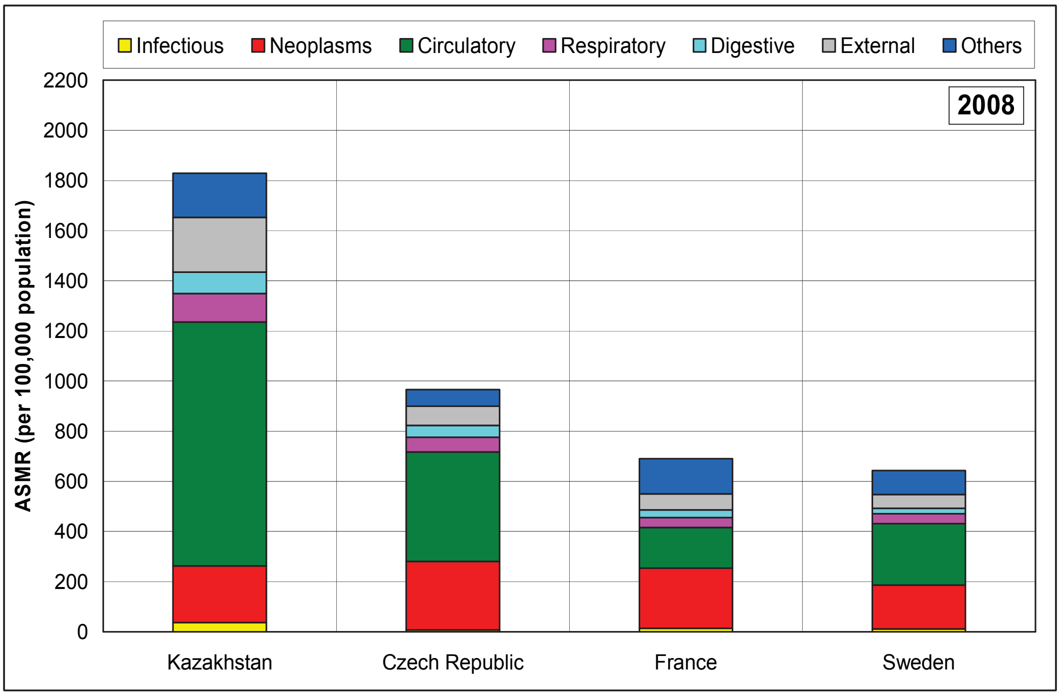
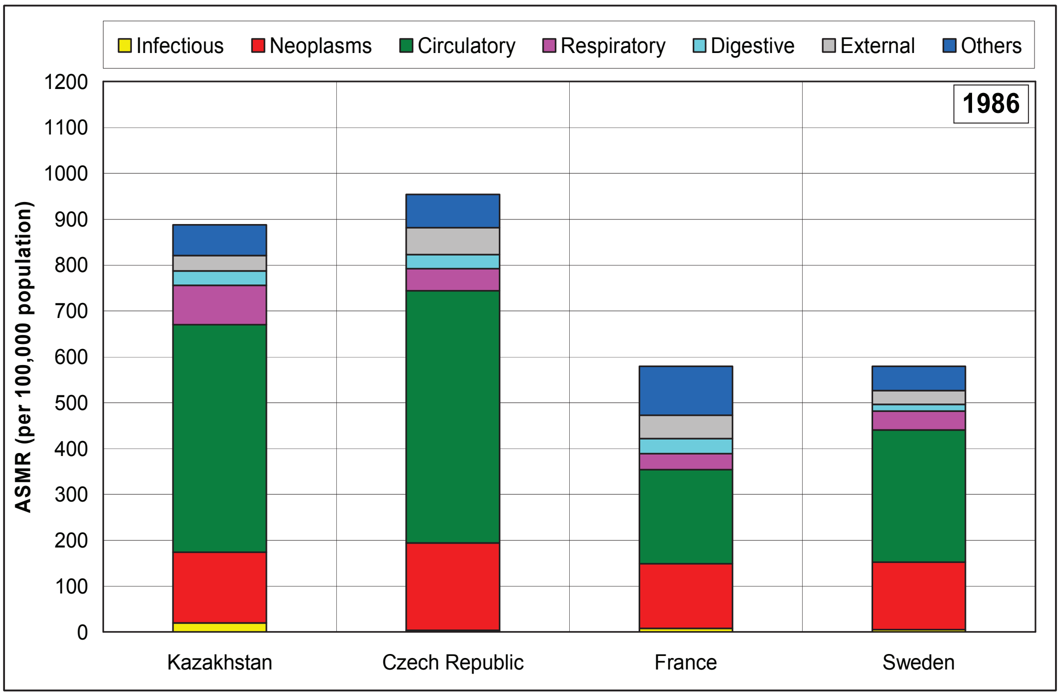


Source: Author's calculations based on data from WHO MDB

Figure A2: Age-standardized mortality rates from main causes of death (per 100,000 population) in the selected countries, females, selected years



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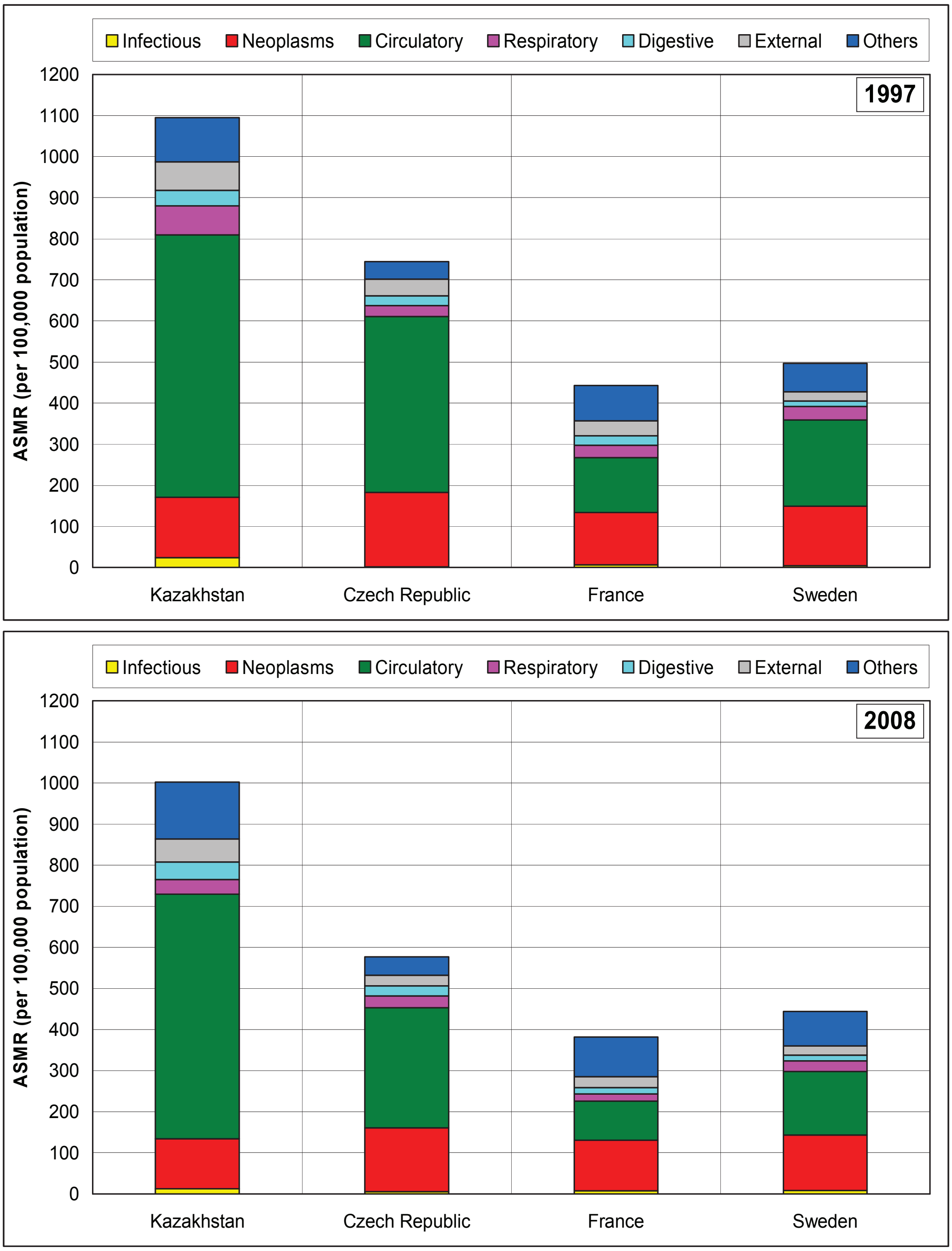
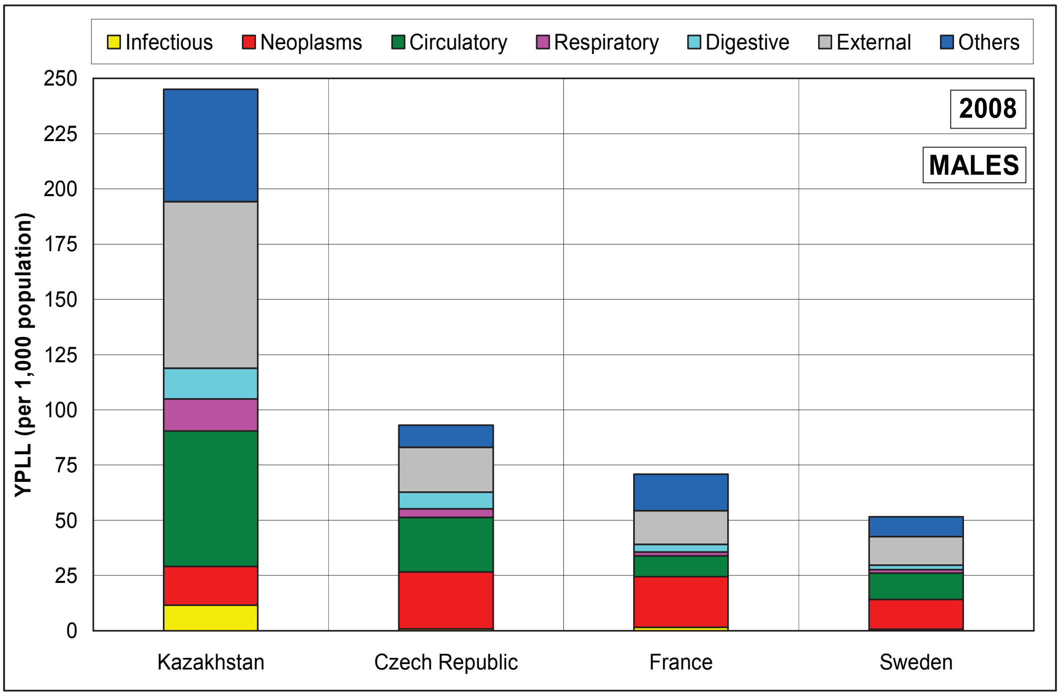
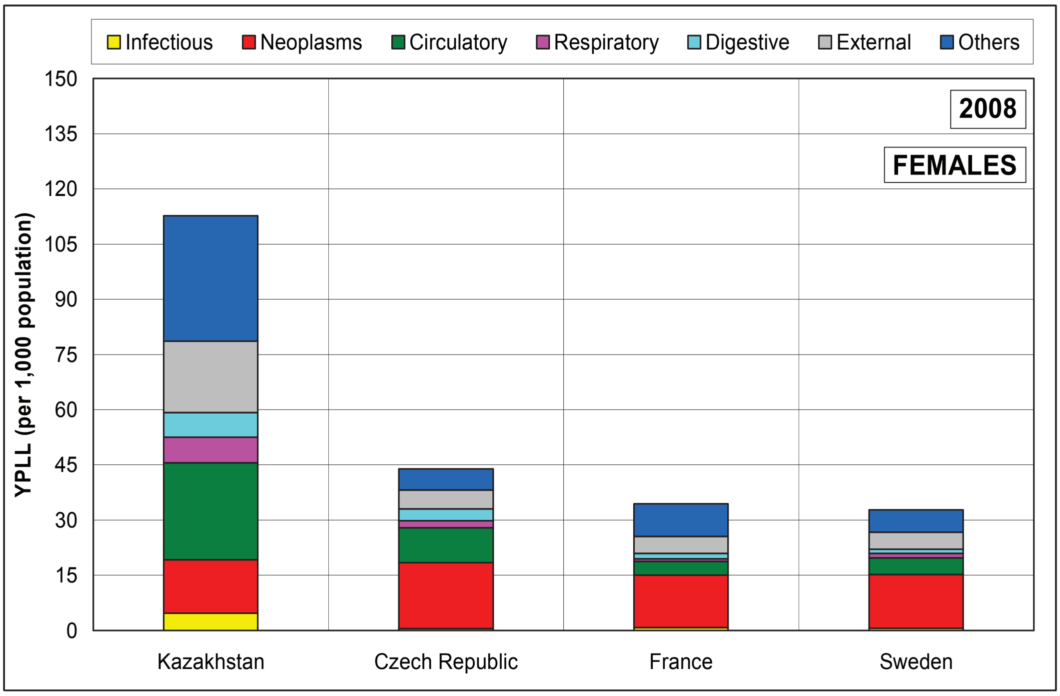


Source: Author's calculations based on data from WHO MDB

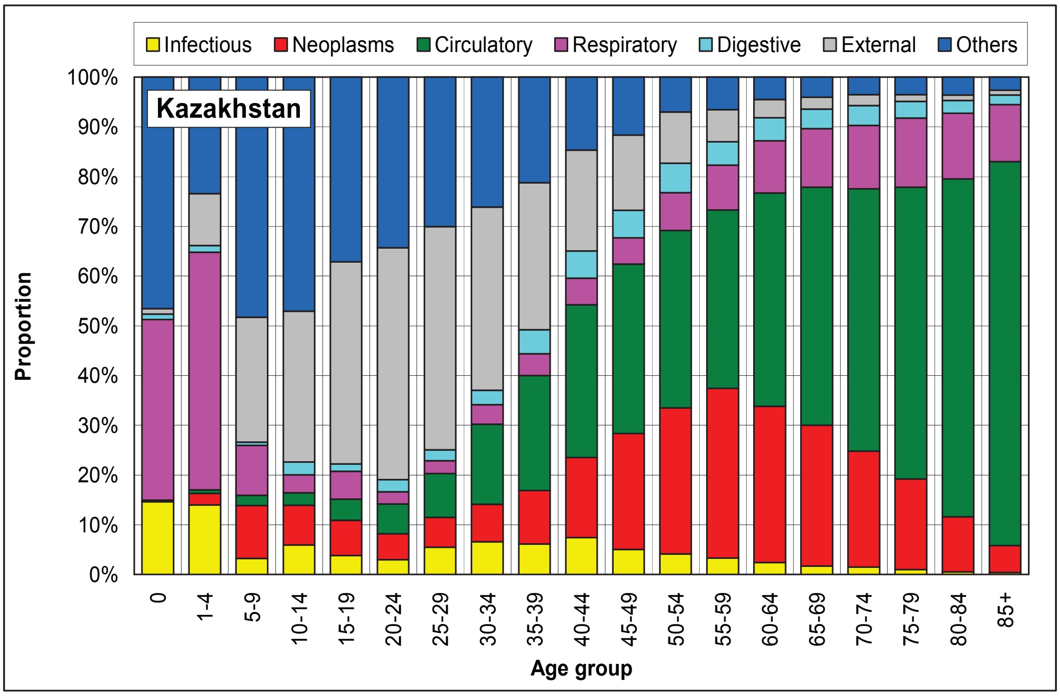
Figure A3: Years of potential life lost from main causes of death (per 1,000 population) in the selected countries, males and females, 2008





Source: Author's calculations based on data from WHO MDB

Figure A4: Mortality structure according to main groups of causes of death and age (in %) in the selected countries, males, 1986



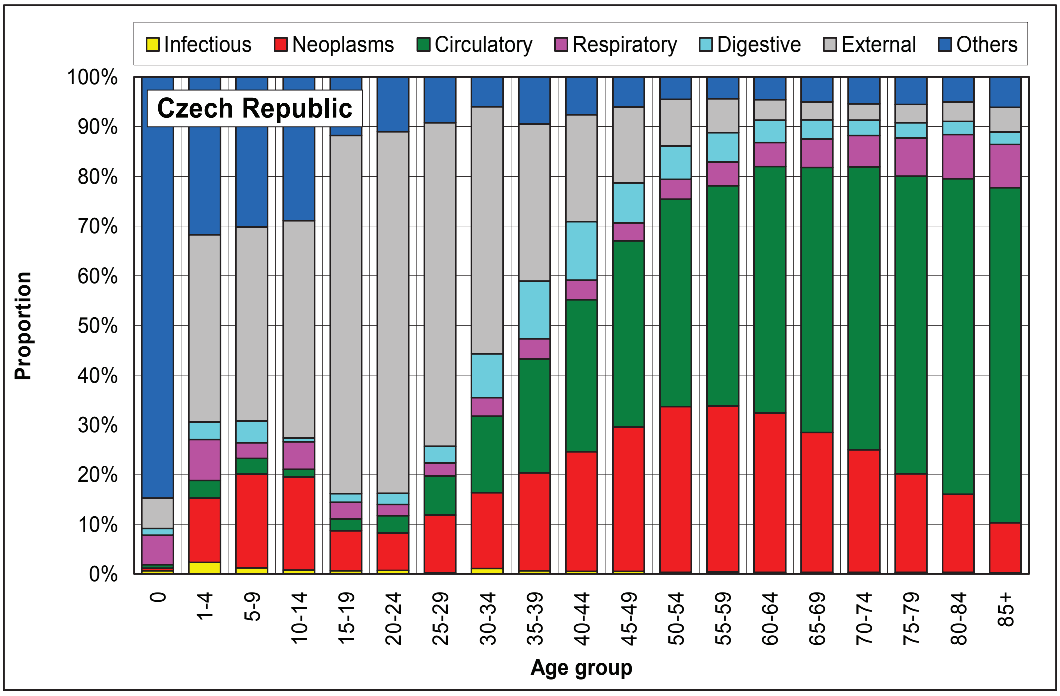
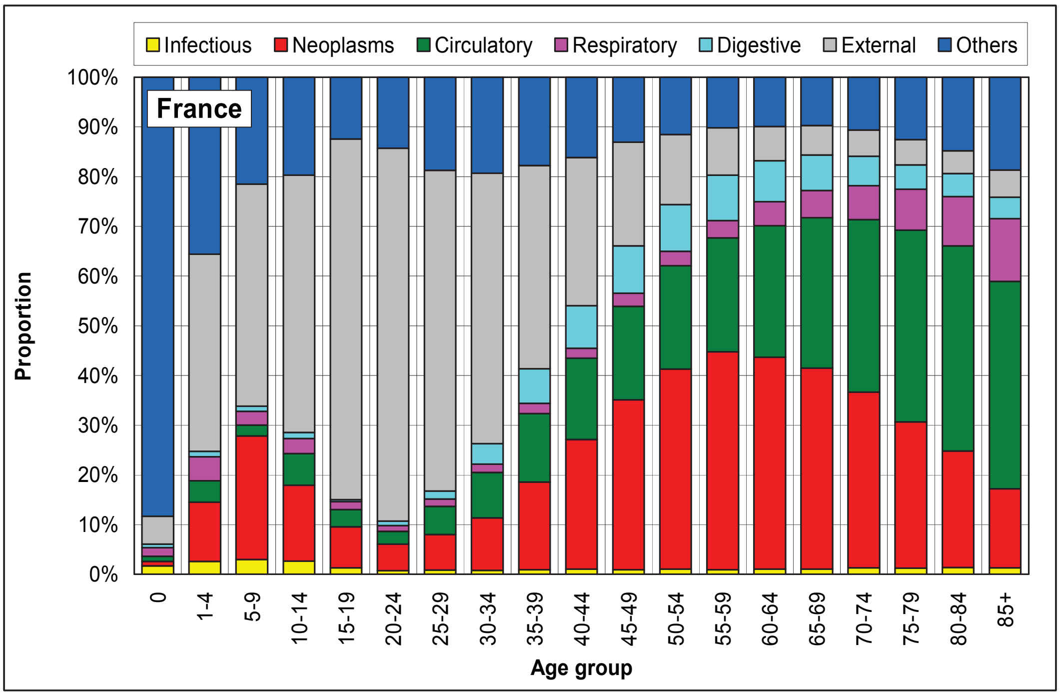
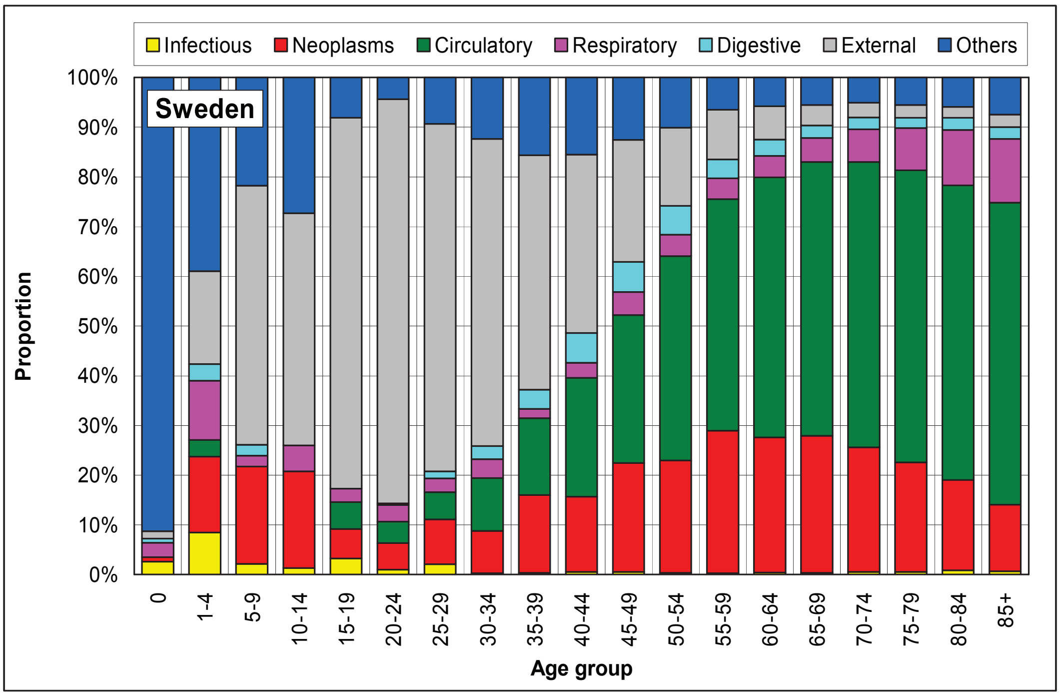


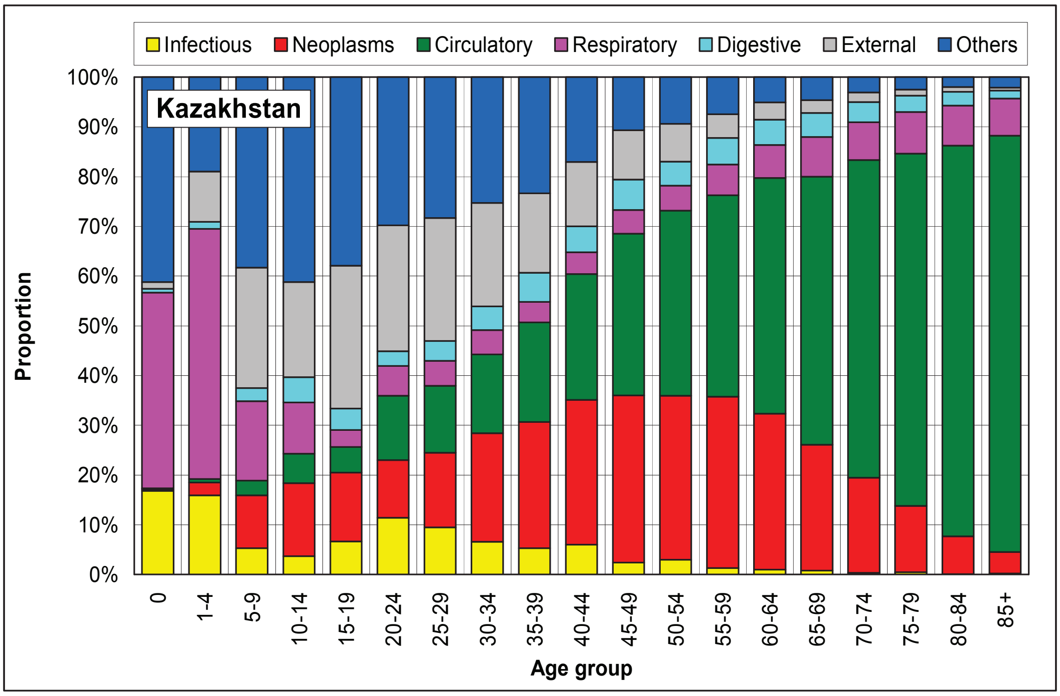
Figure A4: Continued





Source: Author's calculations based on data from WHO MDB

Figure A5: Mortality structure according to main groups of causes of death and age (in %) in the selected countries, females, 1986



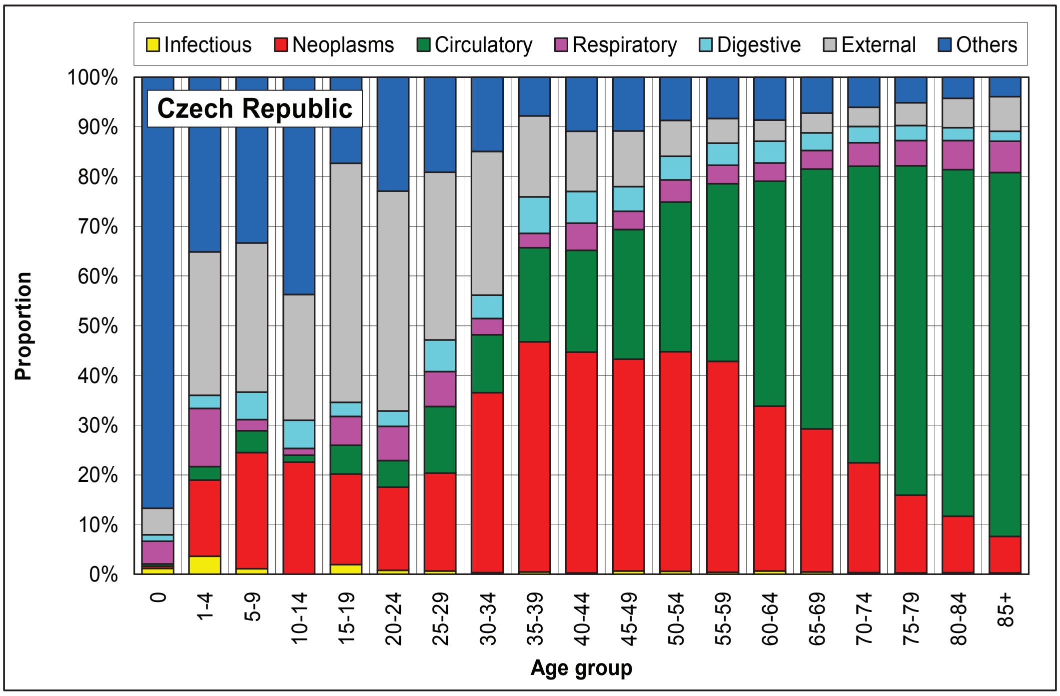
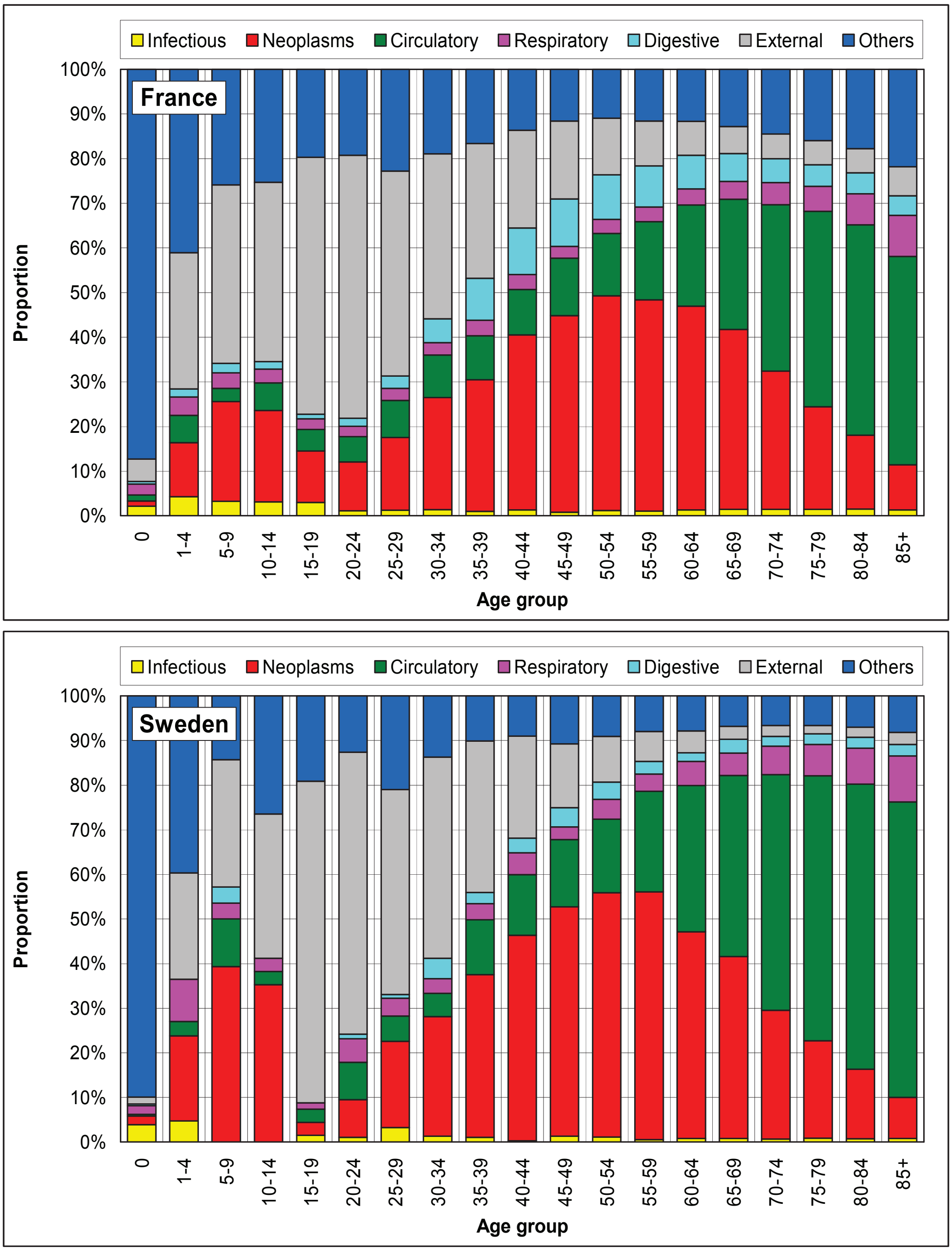
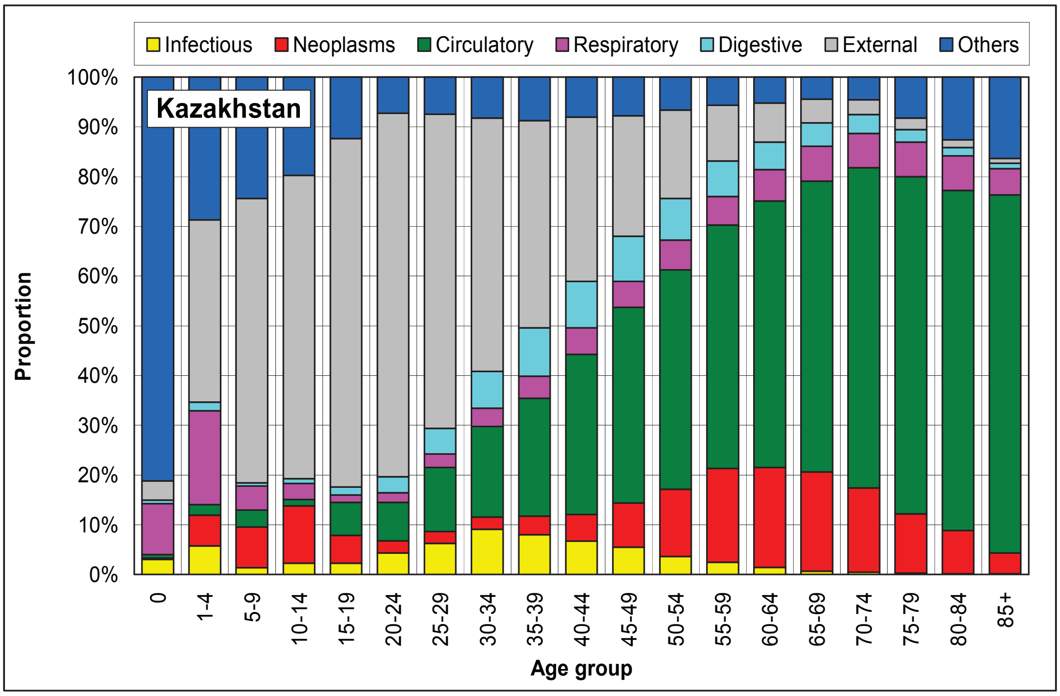


Figure A5: Continued



Source: Author's calculations based on data from WHO MDB

Figure A6: Mortality structure according to main groups of causes of death and age (in %) in the selected countries, males, 2008



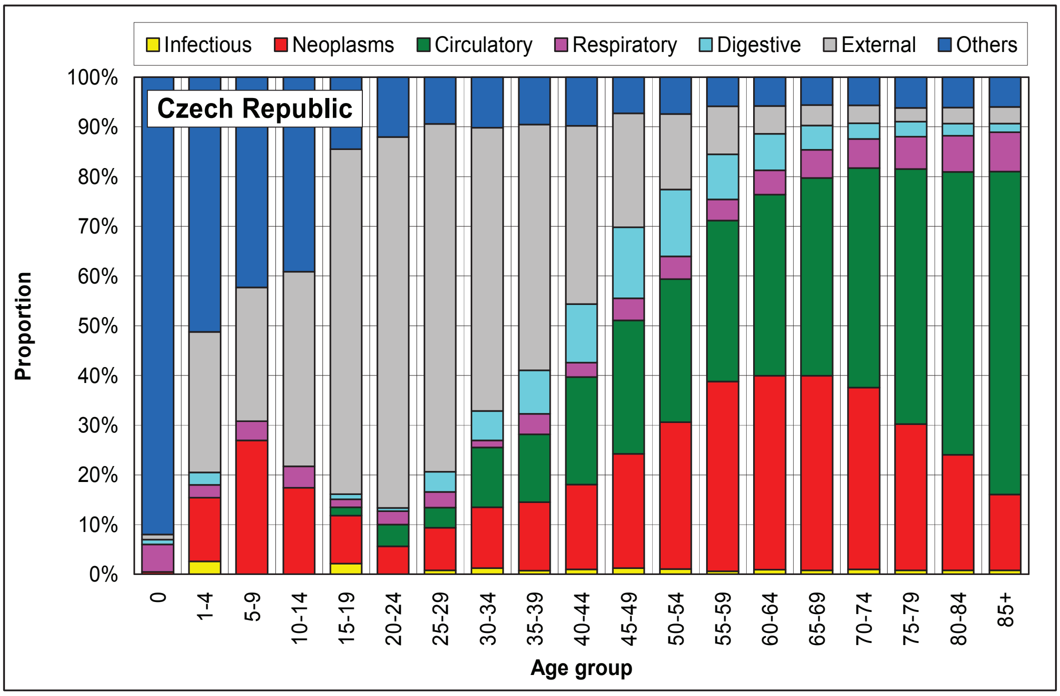
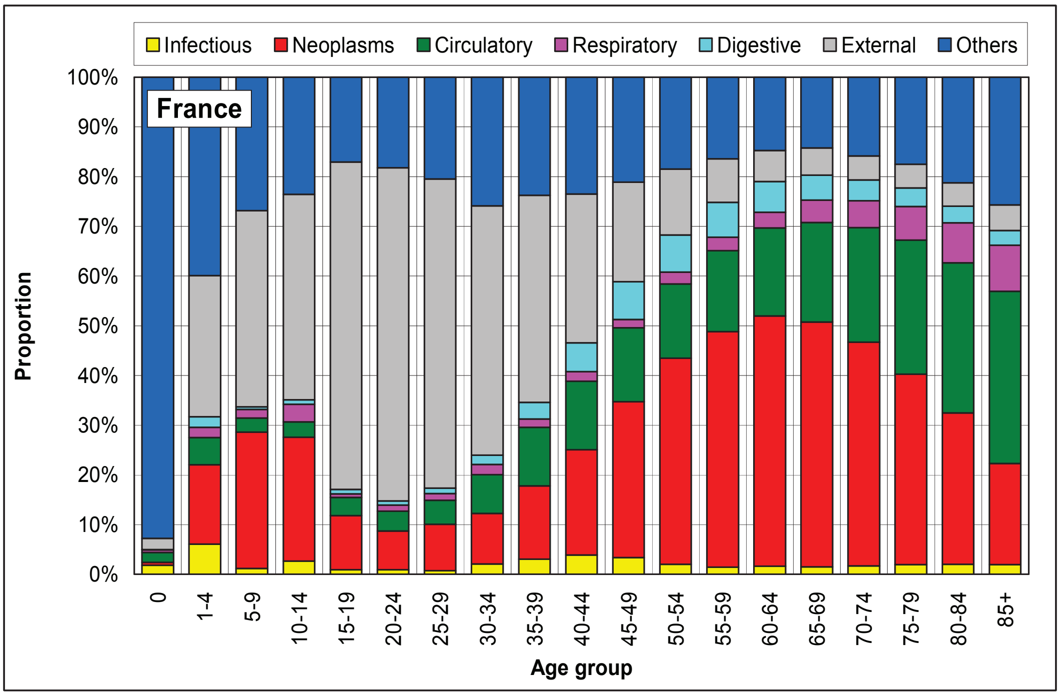
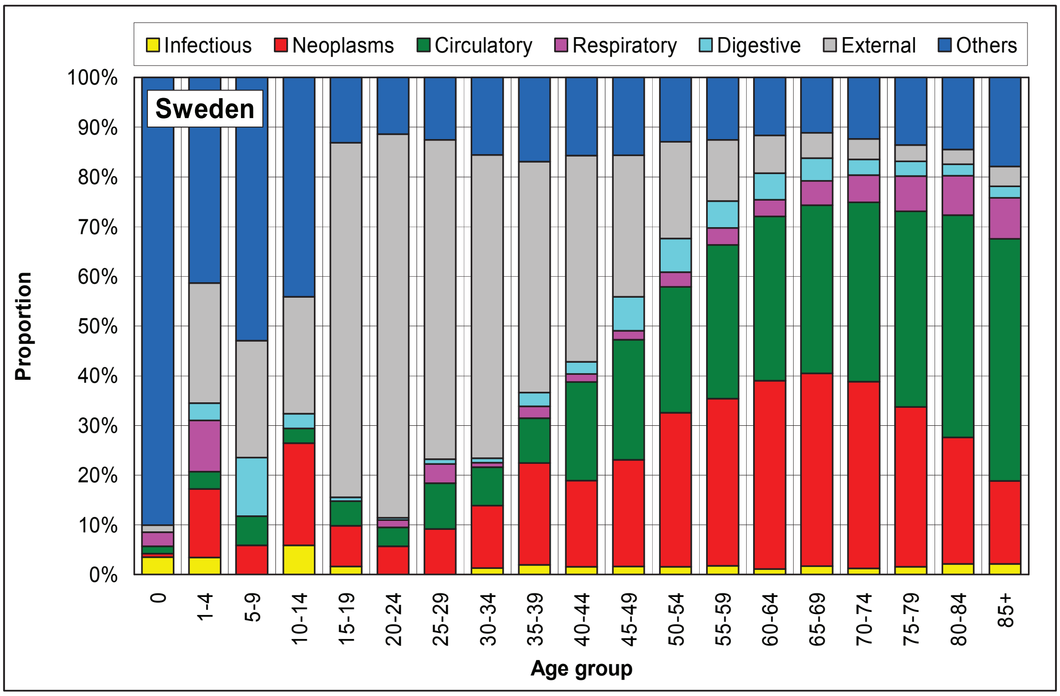


Figure A6: Continued





Source: Author's calculations based on data from WHO MDB

Figure A7: Mortality structure according to main groups of causes of death and age (in %) in the selected countries, females, 2008

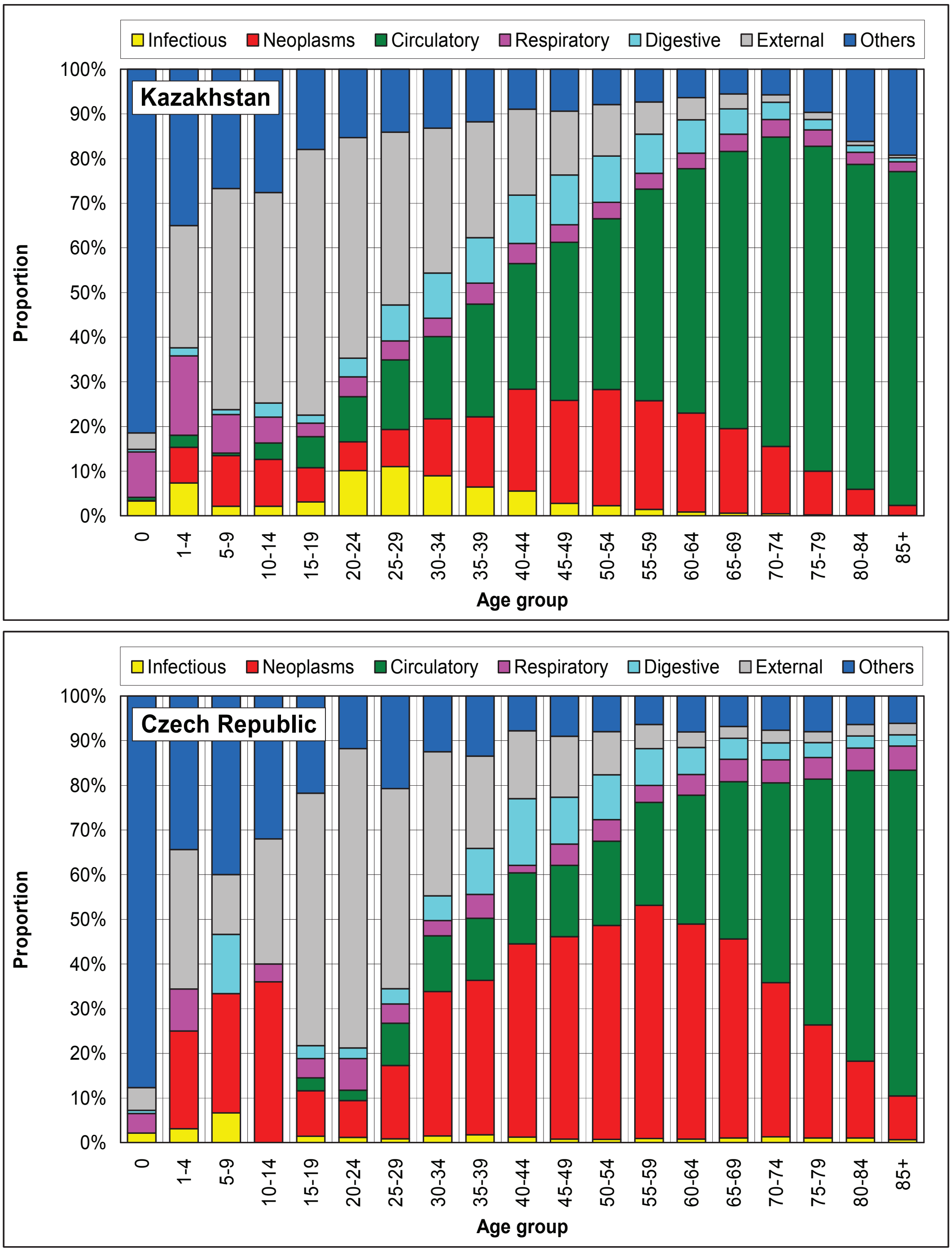
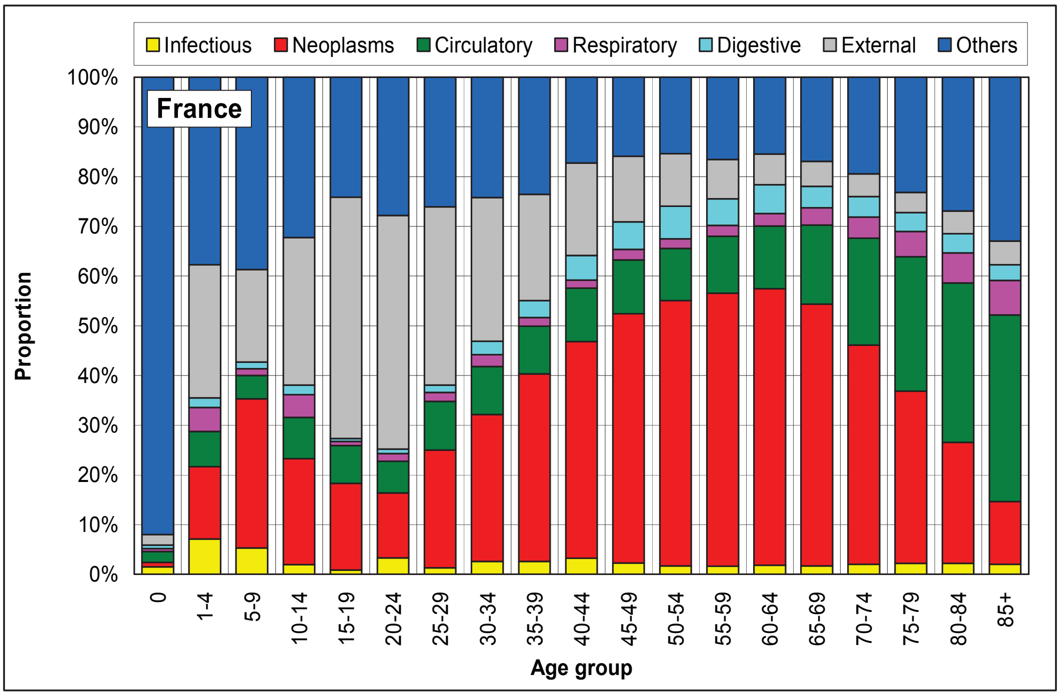
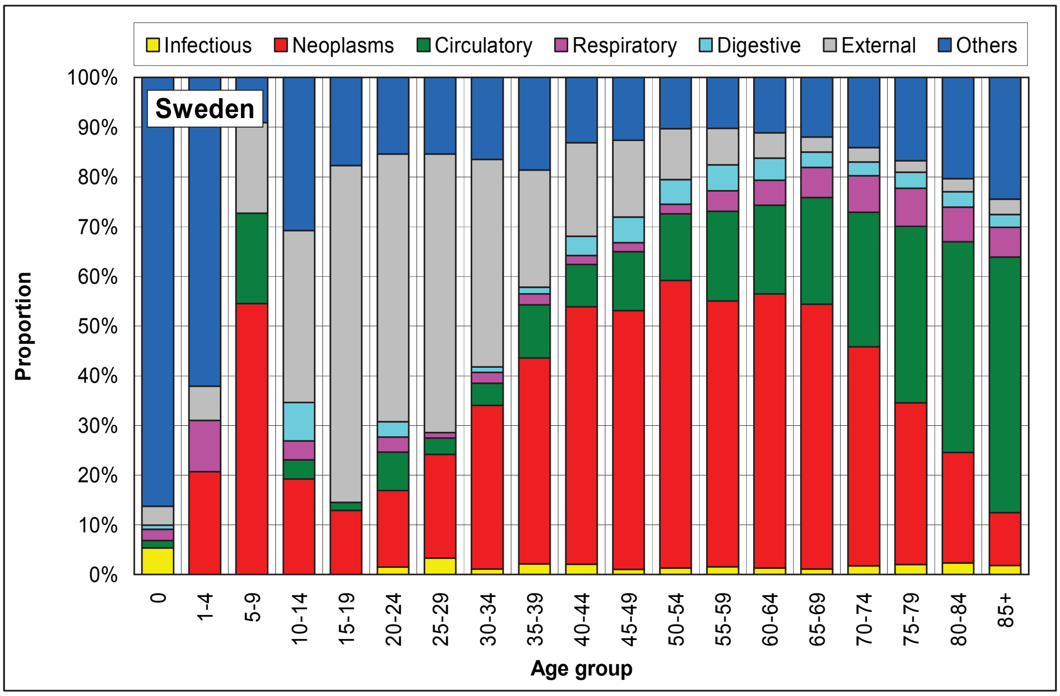


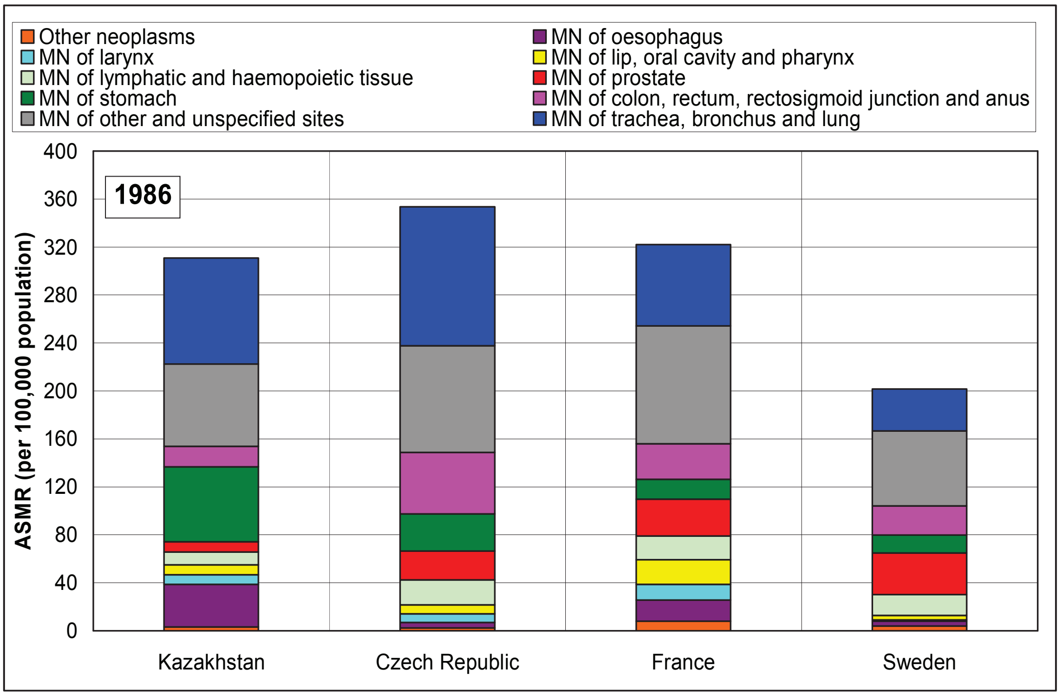
Figure A7: Continued





Source: Author's calculations based on data from WHO MDB

Figure A8: Age-standardized mortality rates from major neoplasms (per 100,000 population) in the selected countries, males, selected years



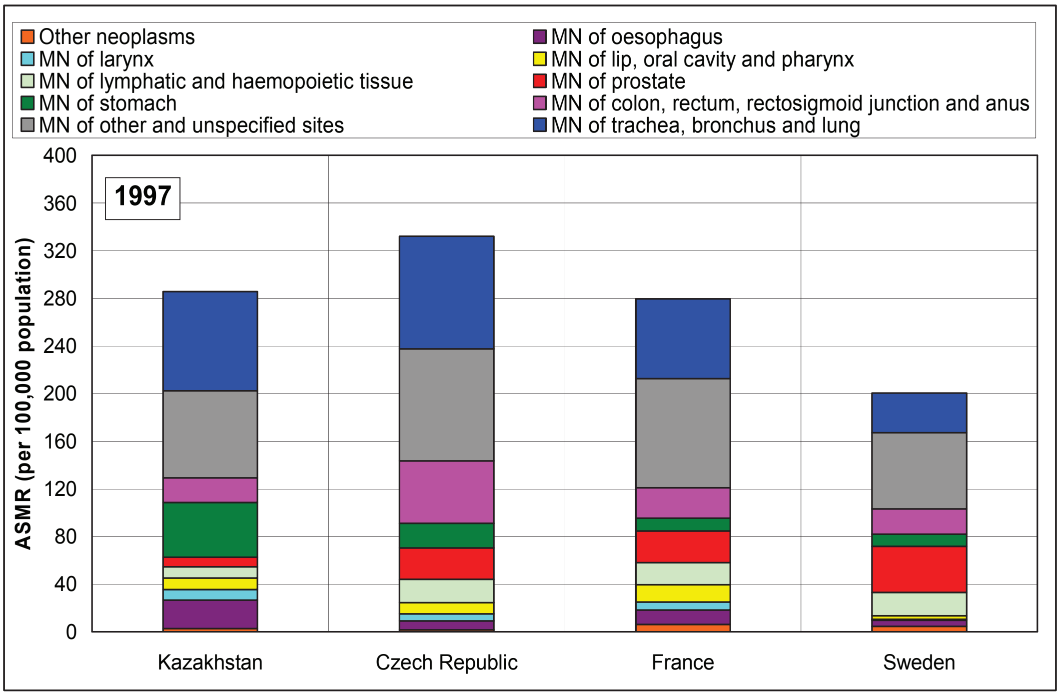
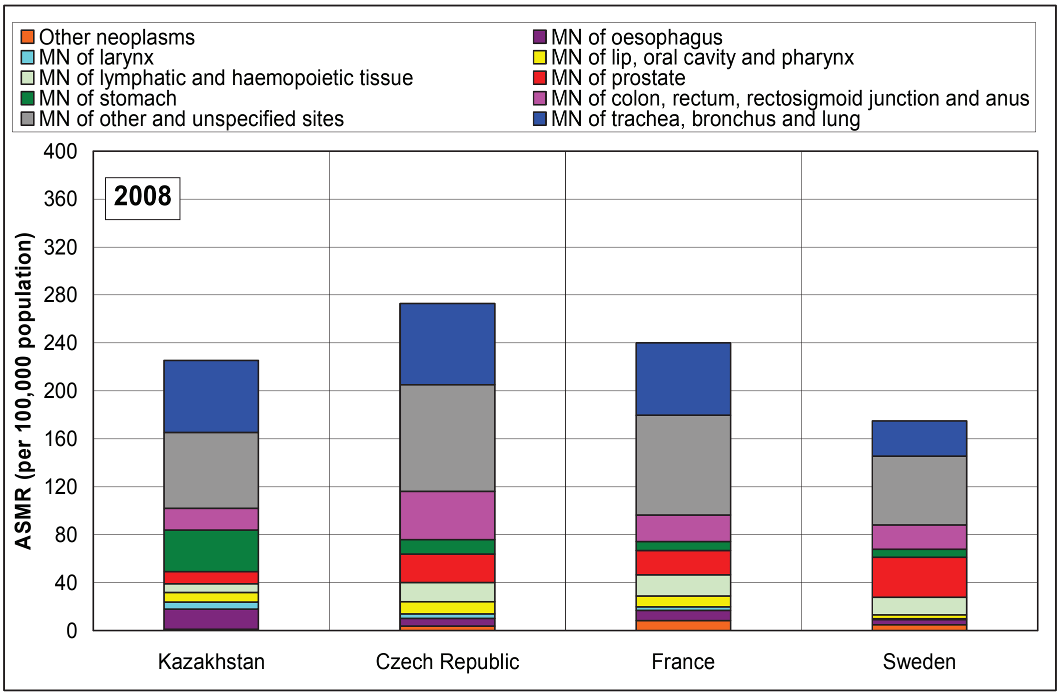
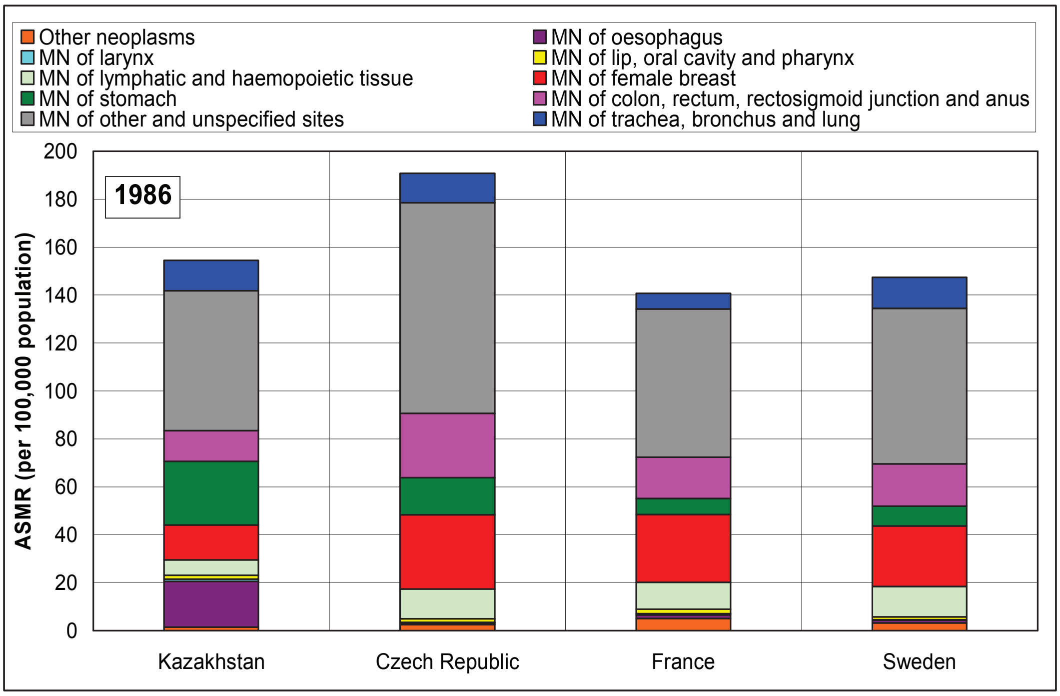


Figure A8: Continued



Source: Author's calculations based on data from WHO MDB

Figure A9: Age-standardized mortality rates from major neoplasms (per 100,000 population) in the selected countries, females, selected years



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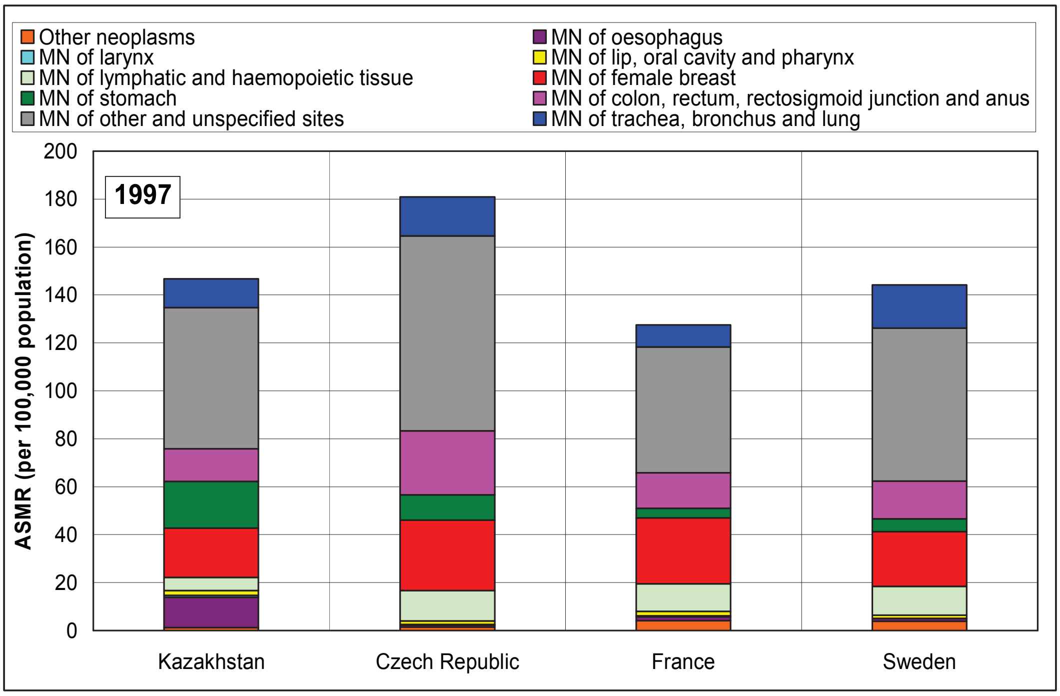
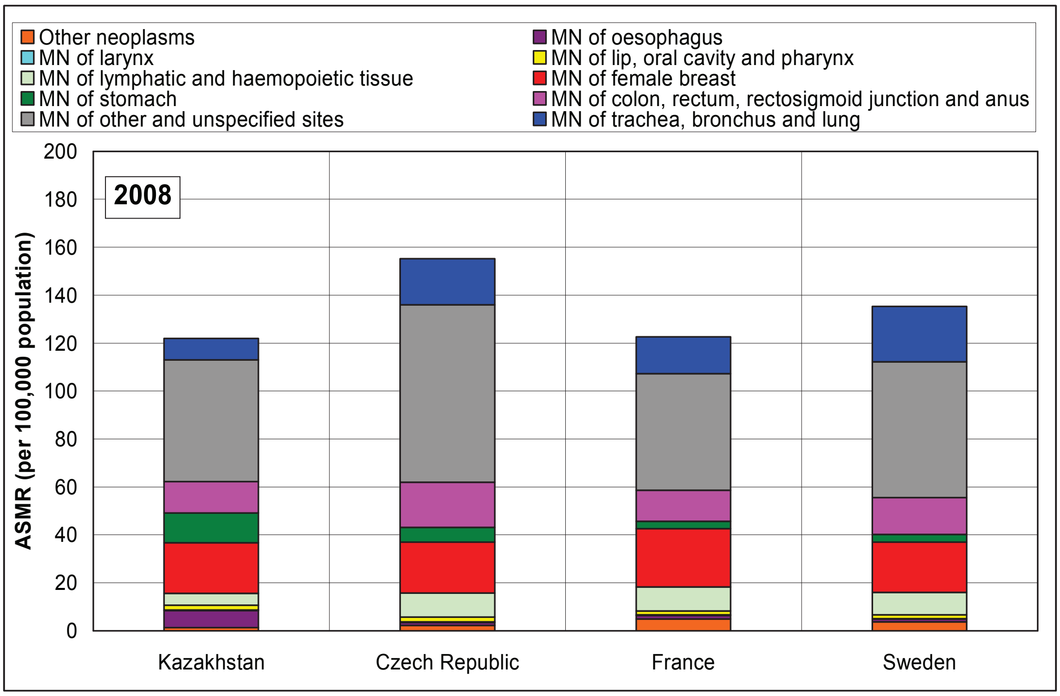
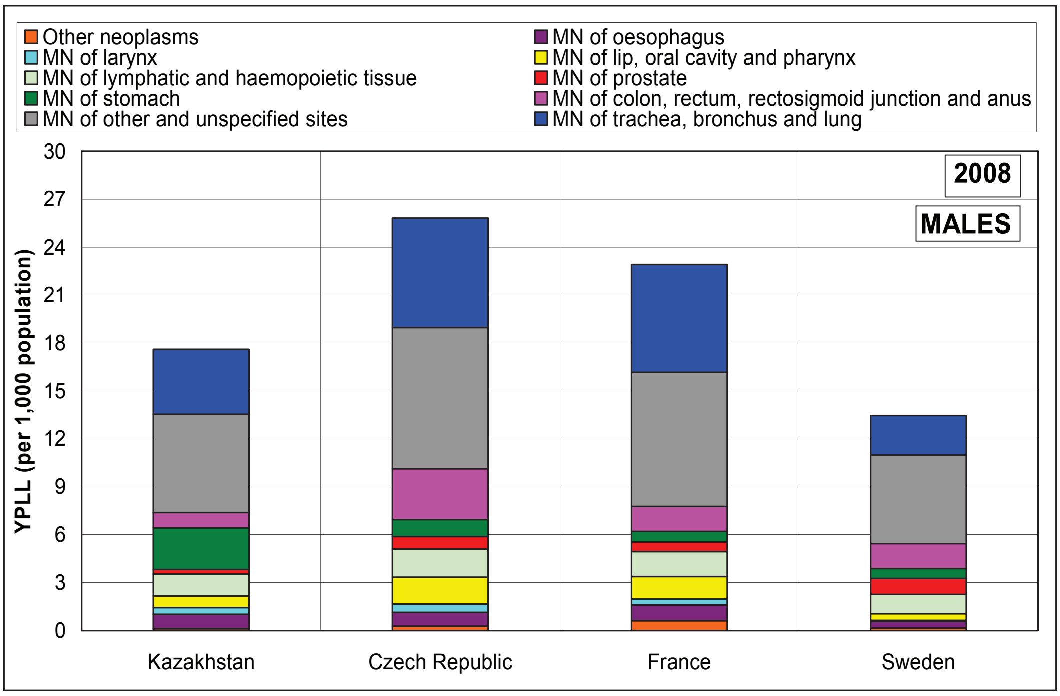
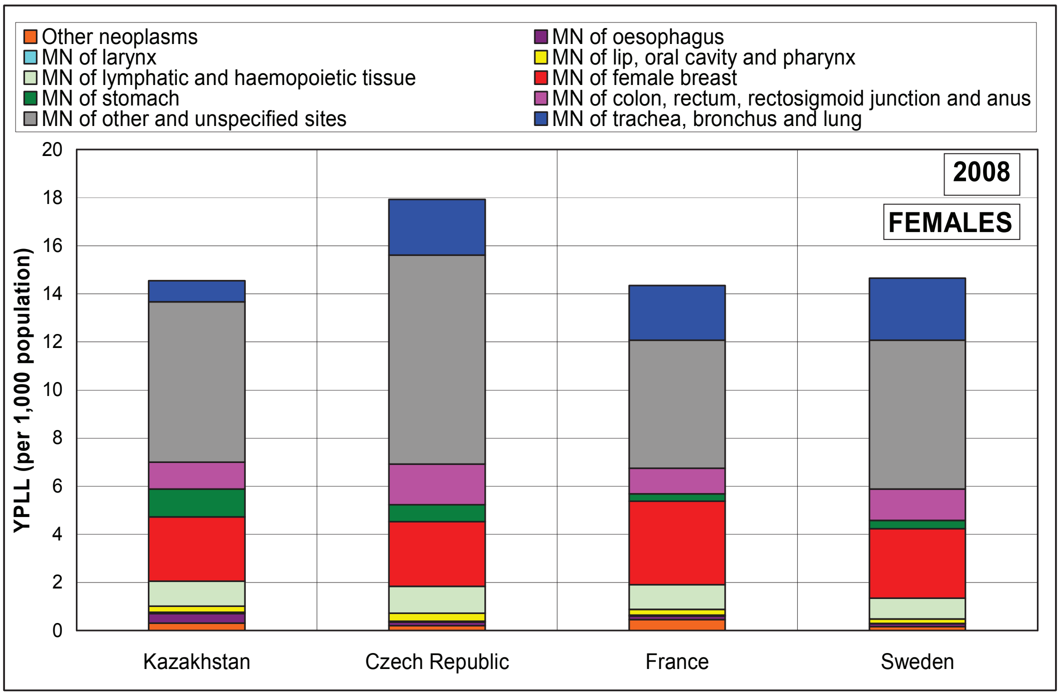




Source: Author's calculations based on data from WHO MDB

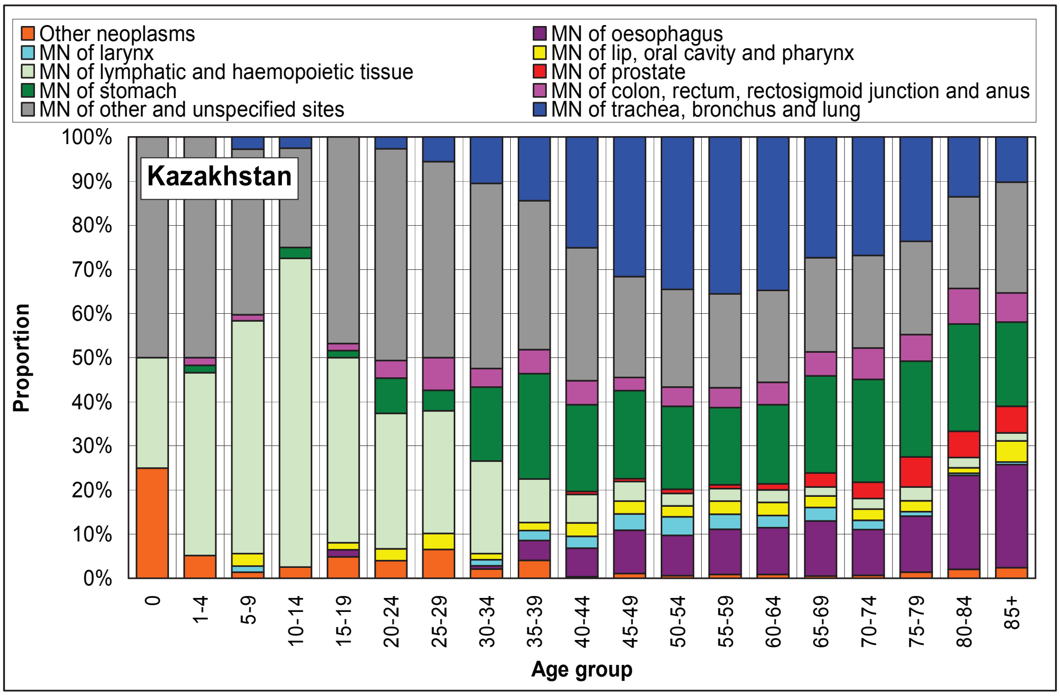
Figure A10: Years of potential life lost from major neoplasms (per 1,000 population) in the selected countries, males and females, 2008





Source: Author's calculations based on data from WHO MDB

Figure A11: Mortality structure according to major neoplasms and age (in %) in the selected countries, males, 1986



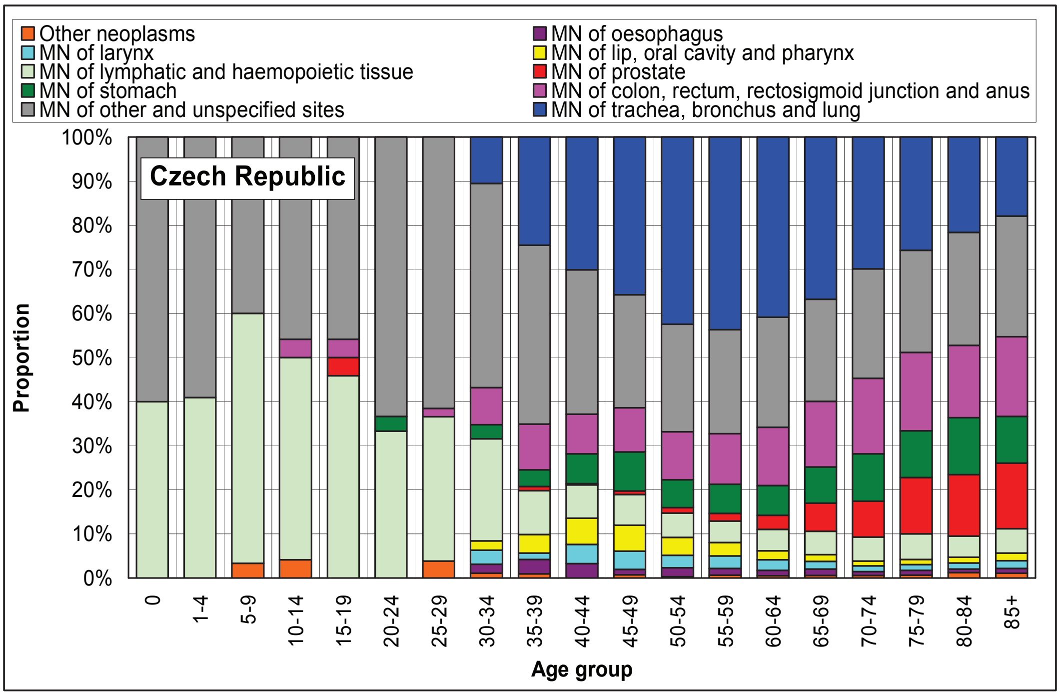
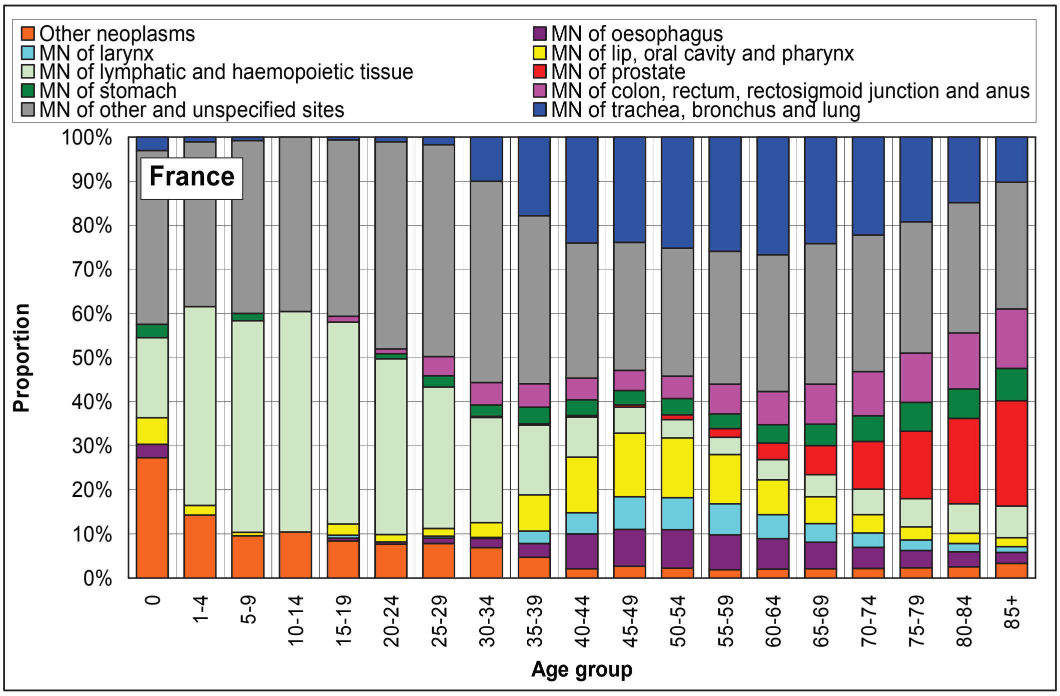
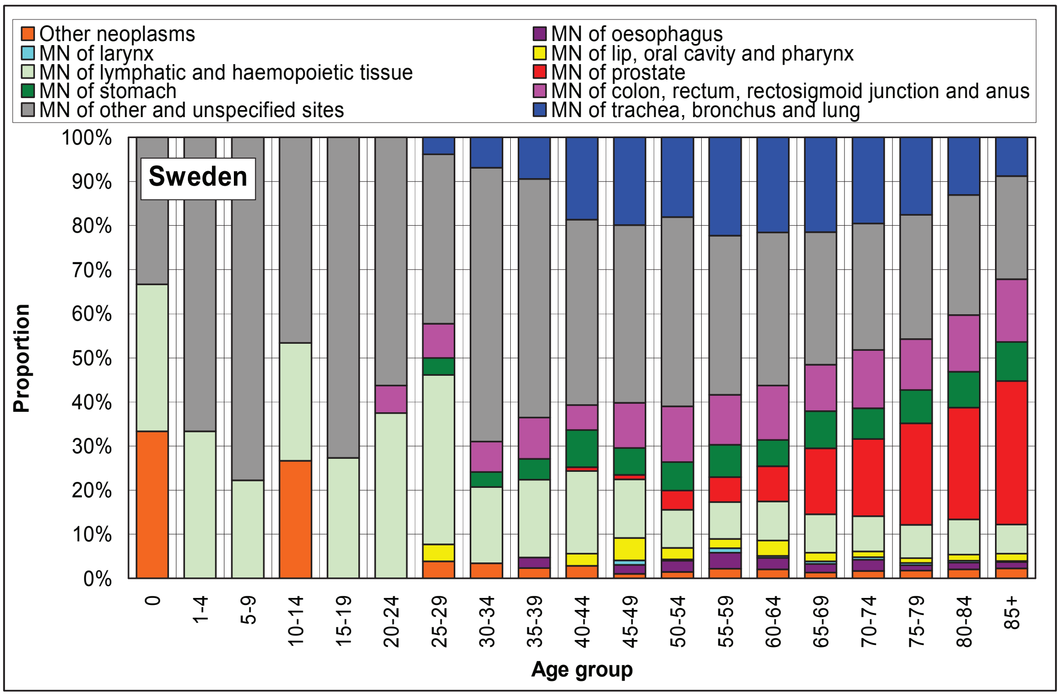


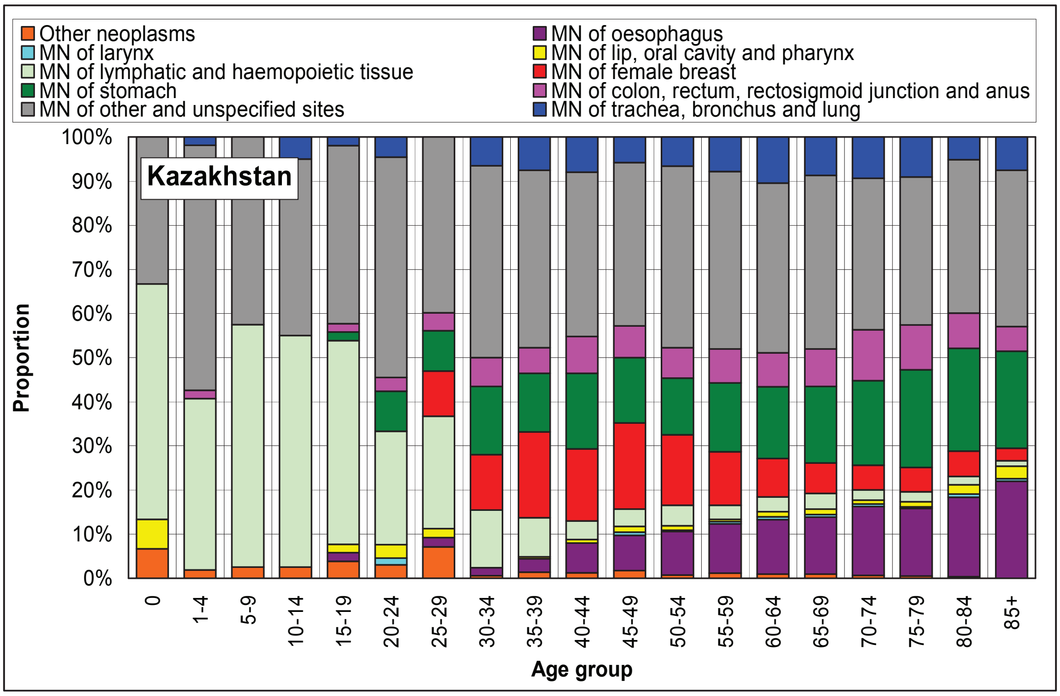
Figure A11: Continued

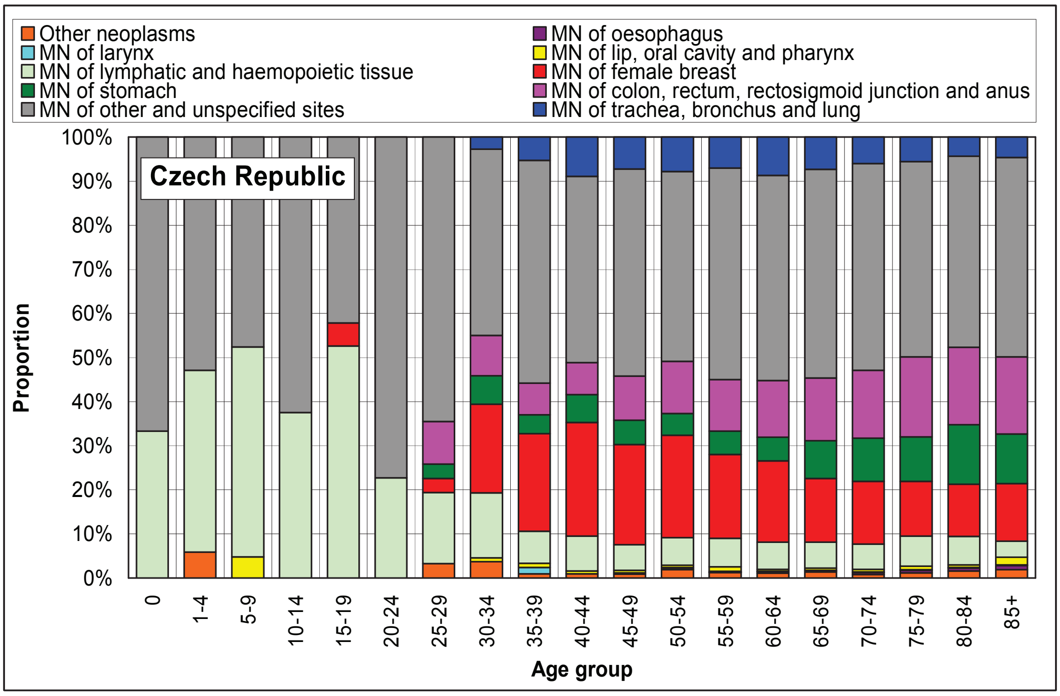




Source: Author's calculations based on data from WHO MDB

Figure A12: Mortality structure according to major neoplasms and age (in %) in the selected countries, females, 1986





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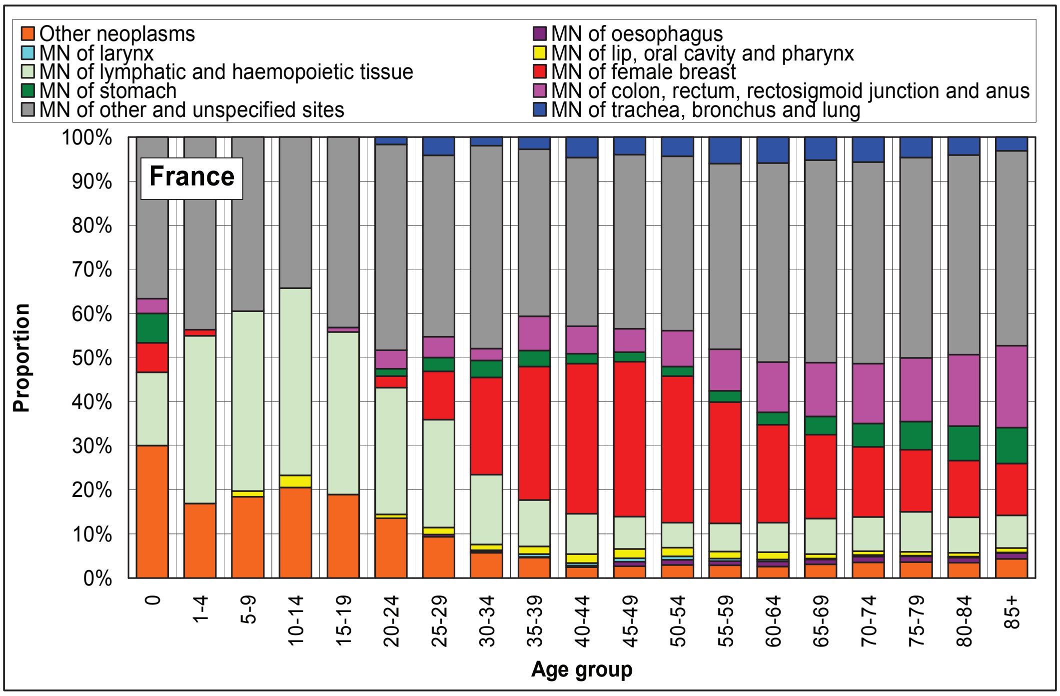
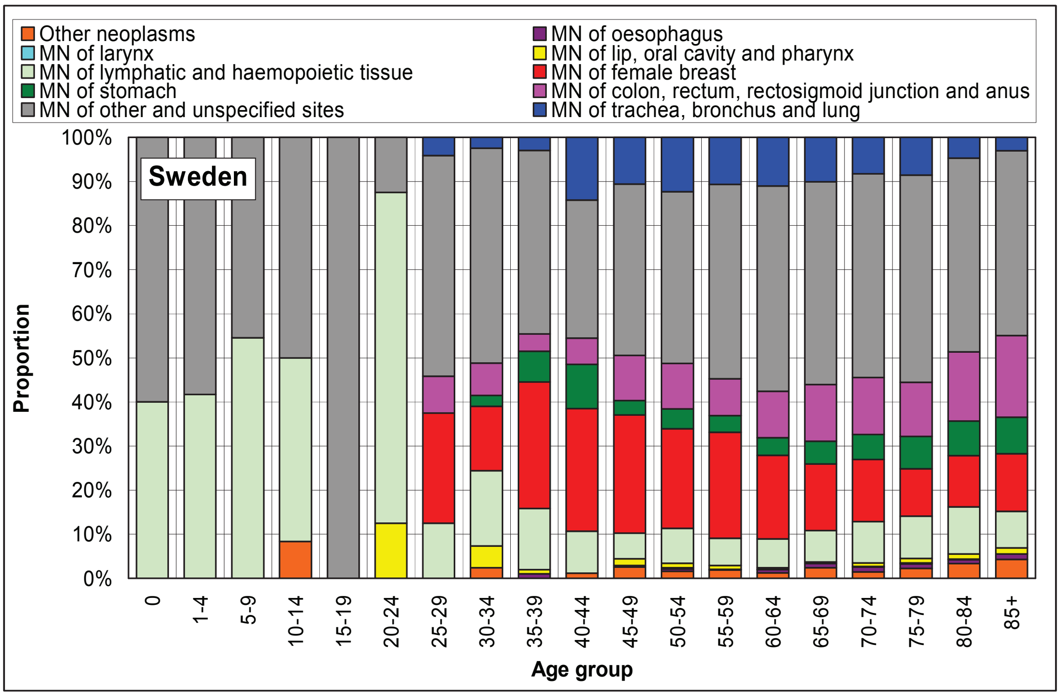
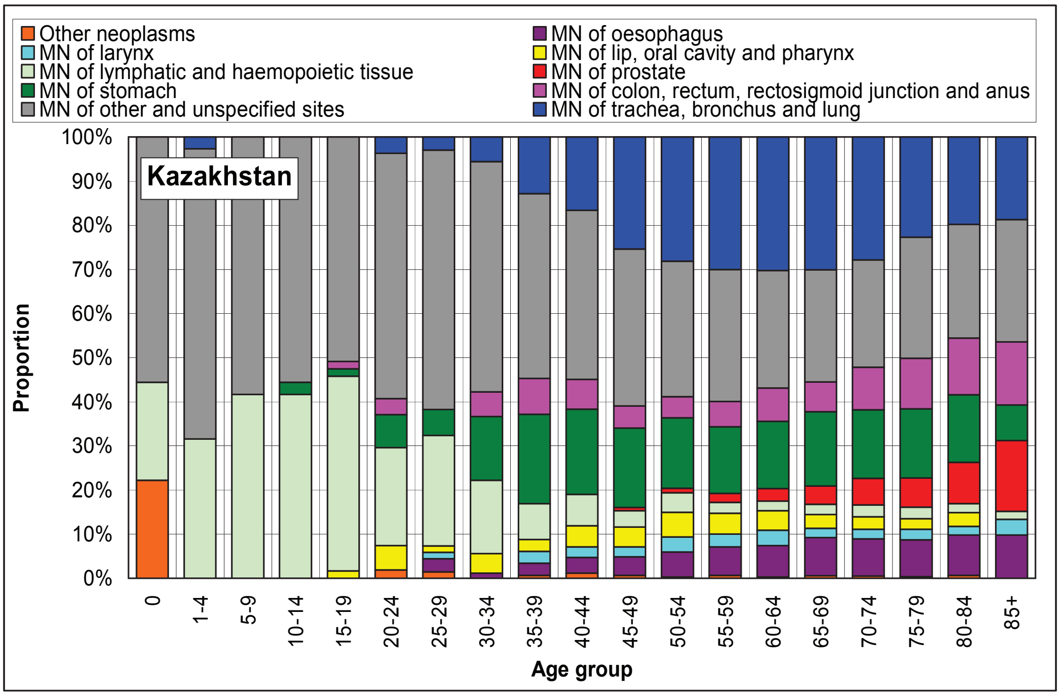
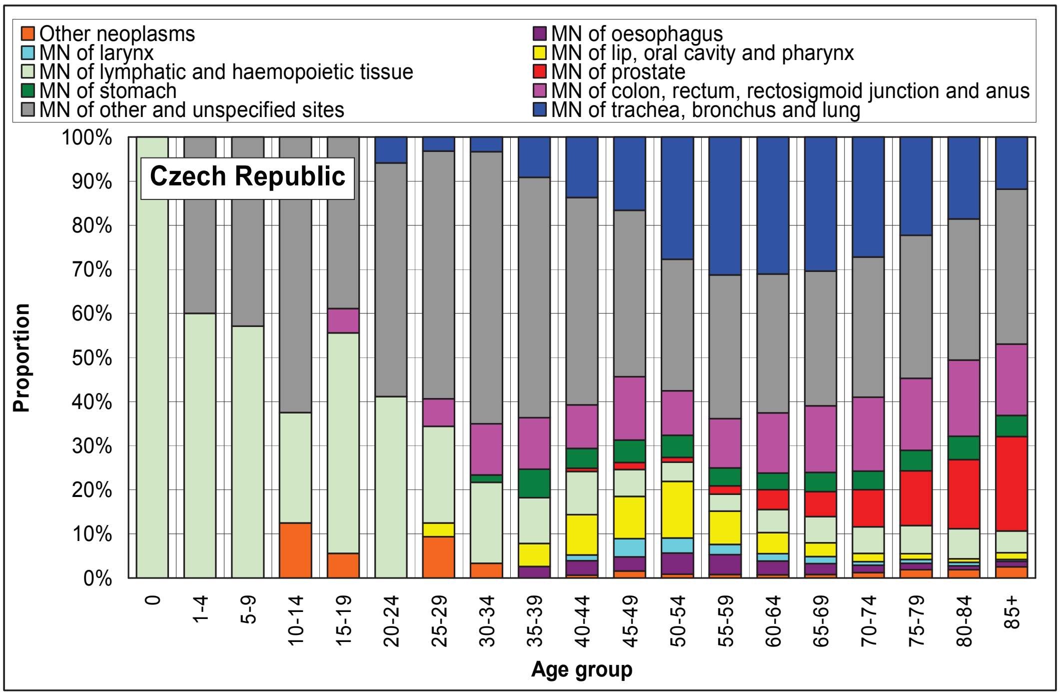




Source: Author's calculations based on data from WHO MDB

Figure A13: Mortality structure according to major neoplasms and age (in %) in the selected countries, males, 2008





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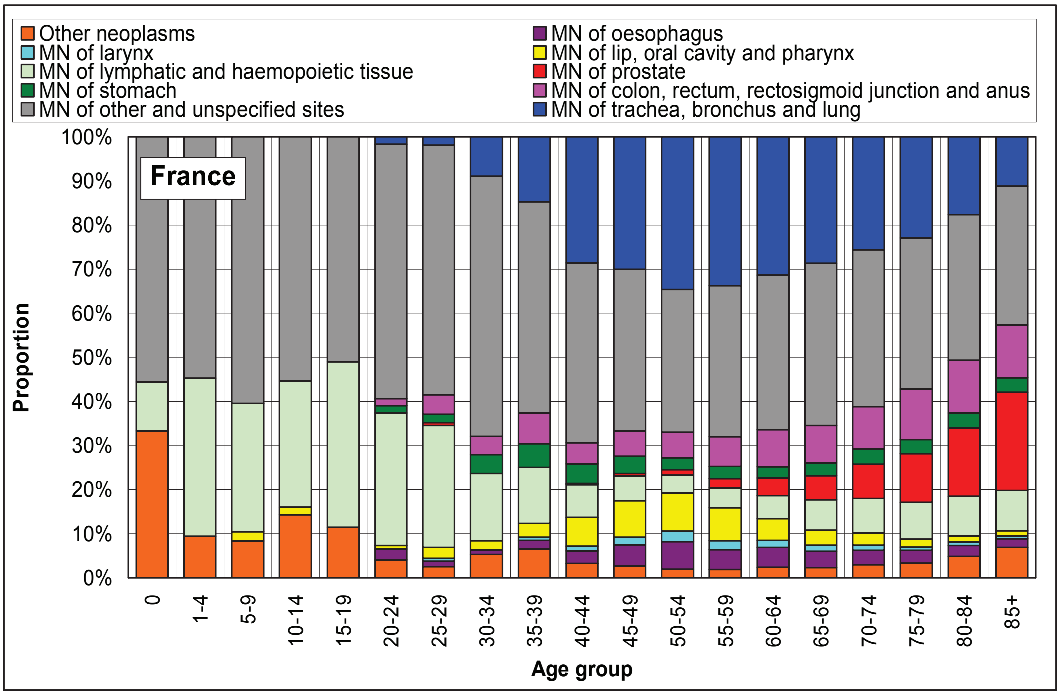
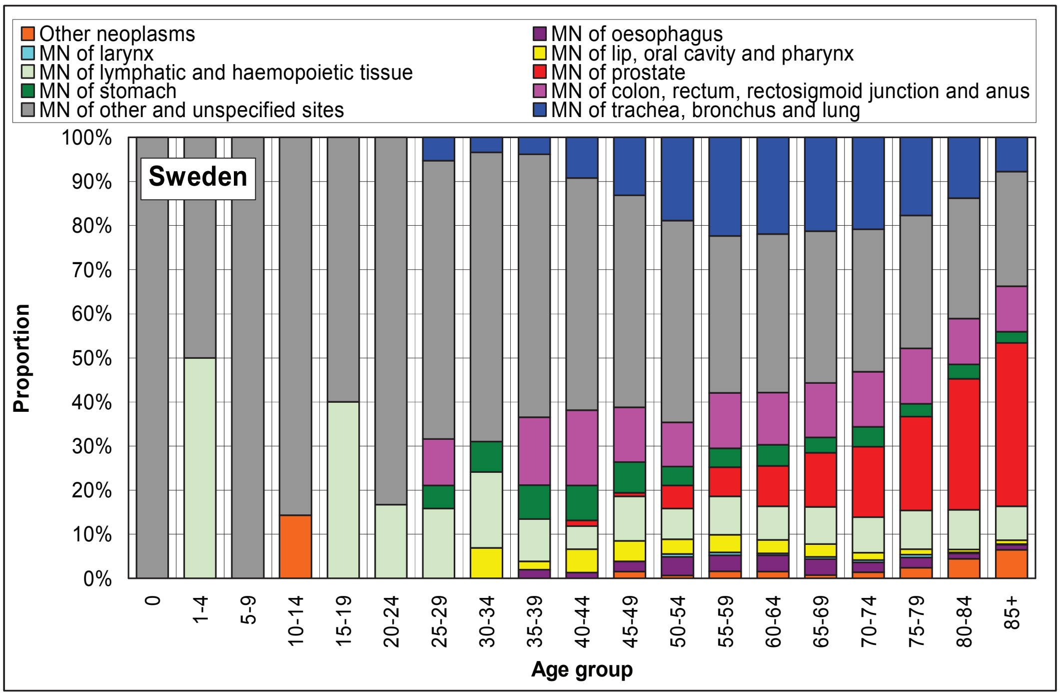
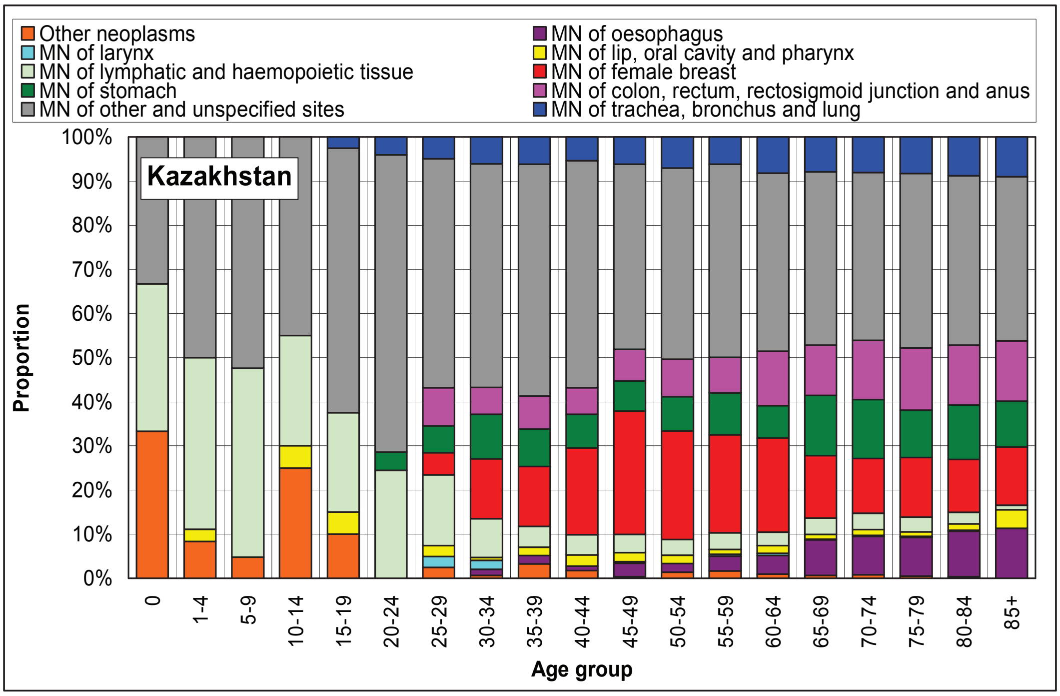
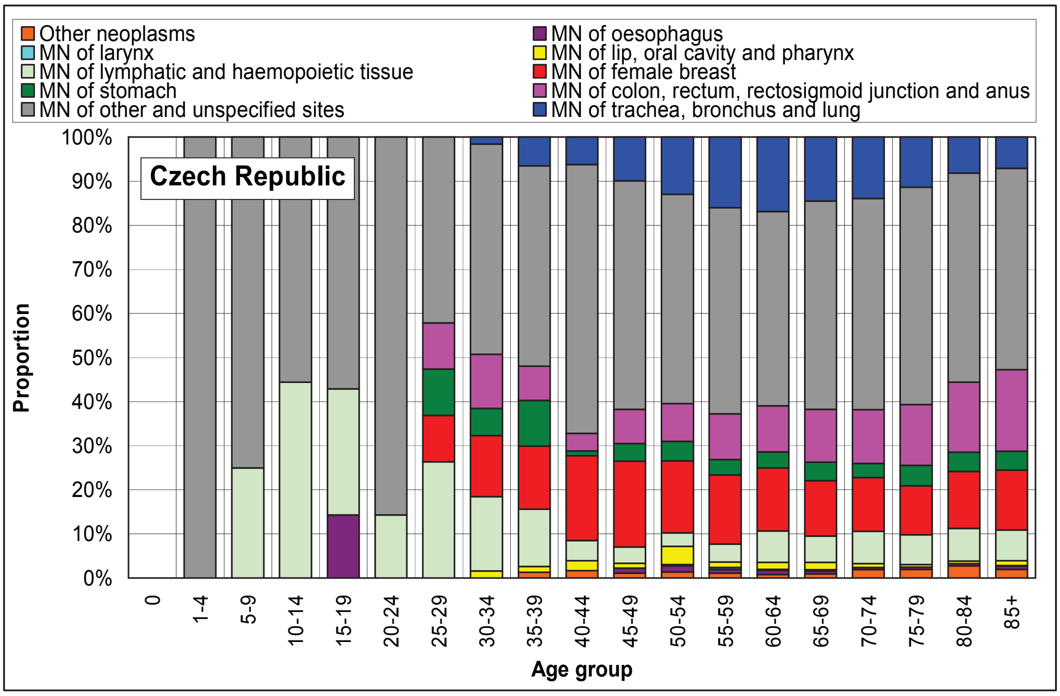




Source: Author's calculations based on data from WHO MDB

Figure A14: Mortality structure according to major neoplasms and age (in %) in the selected countries, females, 2008





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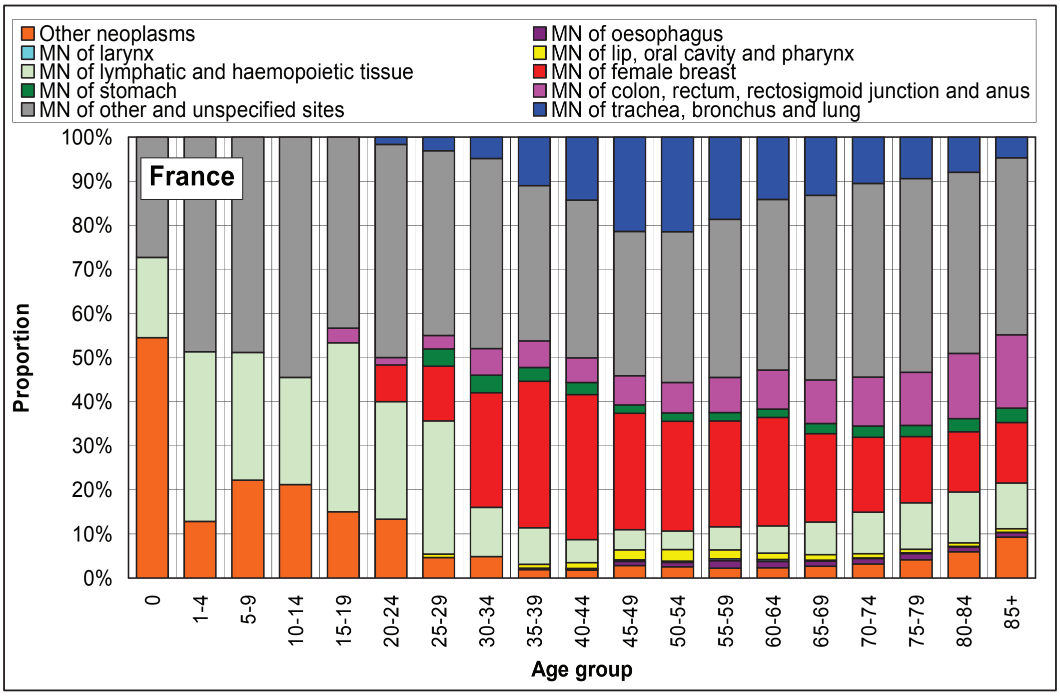

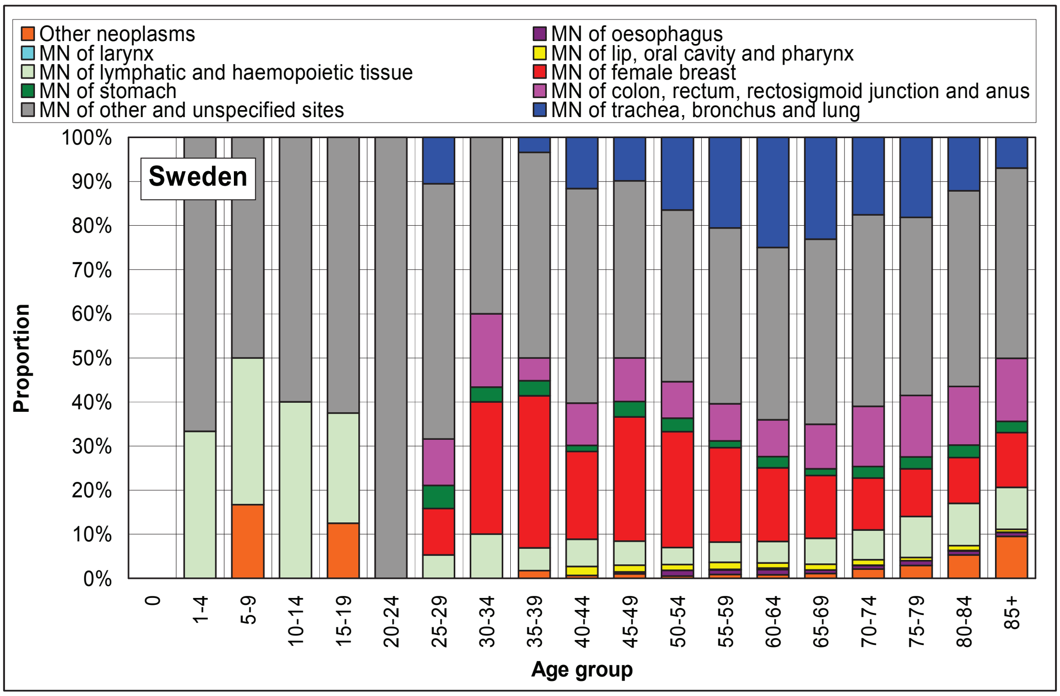

Source: Author’s calculations based on data from WHO MDB